

PROJECT 2.LEGO

1. Basic

Program install

Basic operation

Software download

- <https://education.lego.com/ko-kr/downloads/retiredproducts/mindstorms-ev3-lab/software>
- Window is recommended

MINDSTORMS 소프트웨어를 다운로드하세요 v. 1.4.5

Windows (7, 8.1, 10) ▼

한국어 ▼

(English)

Windows (7, 8.1 & 10)

This desktop application, called EV3 Lab, offers a complete selection of learning possibilities. From simple and advanced programming functionalities to collecting and analyzing sensor data in an intuitive graph environment. The built-in content editor enables you to customize curriculum content and create your own, and allows students to document their work directly in the software.

Key Features and Benefits

- Extensive programming functionalities
 - 48 tutorials (Robot Educator)
 - Data logging
 - Built-in content editor

시스템 요구사항 보기 ▼

다운로드

654 MB

Click

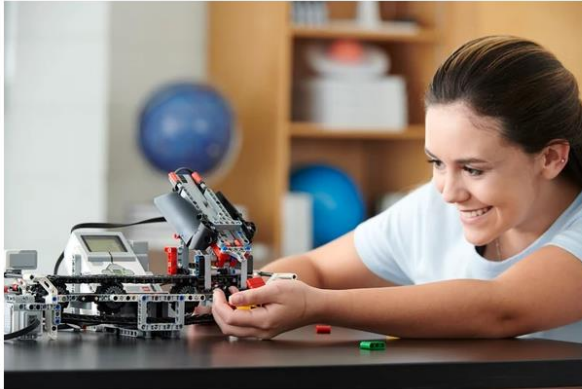
Assembling directions download



알아보기

제품

자원



Product Resources & Support

LEGO® MINDSTORMS® Education EV3

[GO TO PRODUCT PAGE](#)

Teacher Resources

Downloads

Apps

[Building Instructions](#)

Building Instructions for Core Set Models

Program Descriptions for Core Set Models

Building Instructions for Robot Educator

Building Instructions for Expansion Set Models

Click

Building Instructions for Core Set Models

Building Instructions for Core Set Models

Color Sorter

[다운로드](#)



Gyro Boy

[다운로드](#)



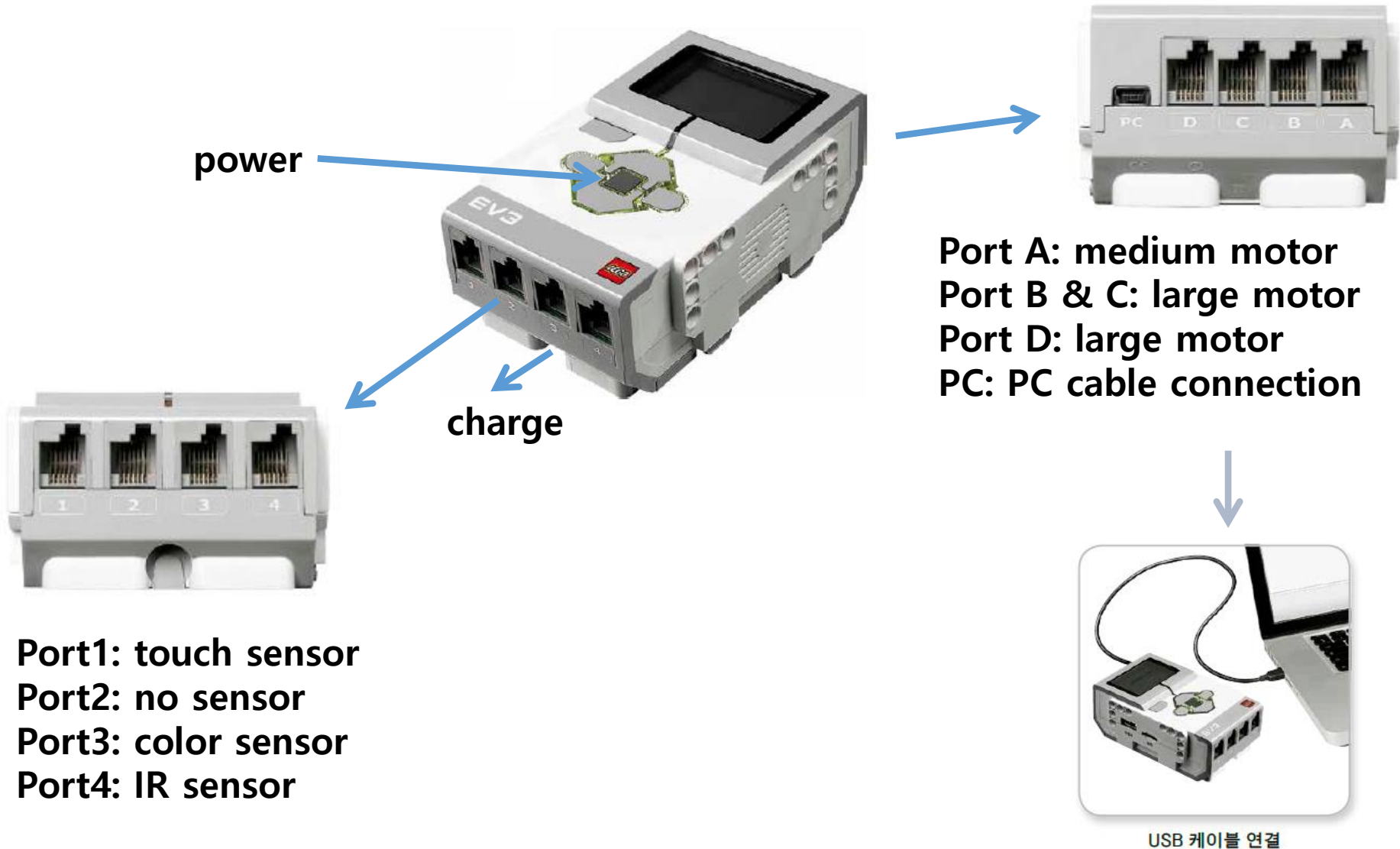
Puppy

[다운로드](#)



2. EV3 brick instructions

EV3 brick?



EV3 brick?

Wireless
connection
condition icon

무선 연결 상태 아이콘
(왼쪽부터):



블루투스가 활성화되었지만
연결되지 않았거나 다른 블루투스
장치에 보이지 않음



블루투스가 활성화되었으며 다른
블루투스 장치에 보임



블루투스가 활성화되었으며 EV3
브릭이 다른 블루투스 장치에 연결됨



블루투스가 활성화되고 보이며, EV3
브릭이 다른 블루투스 장치에 연결됨



Wi-Fi가 활성화되었지만 네트워크에
연결 안 됨



Wi-Fi가 활성화되었으며 네트워크에
연결됨

브릭 이름

USB

다른 장치와 연결된 USB 설정



배터리 잔량

브릭 버튼

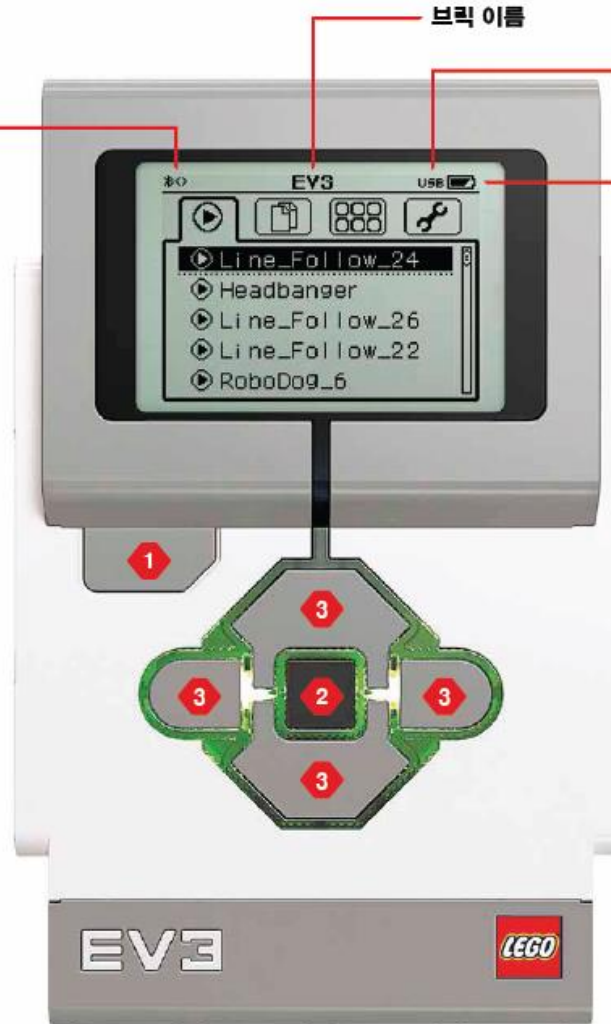
1. 뒤로

실행 중인 프로그램을 중단하고
EV3 브릭을 종료하는 등 역방향
작업을 하는 데 사용됩니다.

2. 가운데

가운데 버튼을 누르면 종료하거나,
원하는 설정을 선택하거나, 브릭
프로그램 앱에서 블록을 선택하는
등 다양한 질문에 "확인"으로
반응합니다. 예를 들어 이 버튼을
누르면 확인란을 선택할 수
있습니다.

3. 왼쪽, 오른쪽, 위, 아래
가운데 버튼을 누르면 "확인"
으로 반응합니다. 이 네 개의
버튼은 EV3 브릭의 콘텐츠를
탐색하는 데 사용됩니다.



EV3 brick button operate



최근 실행 화면

recent practice
screen



파일 탐색 화면

File search
screen



브릭 앱 화면

Brick application
screen



설정 화면

Set-up screen



포트 보기 화면

Port screen



모터 제어 화면

Motor control
screen

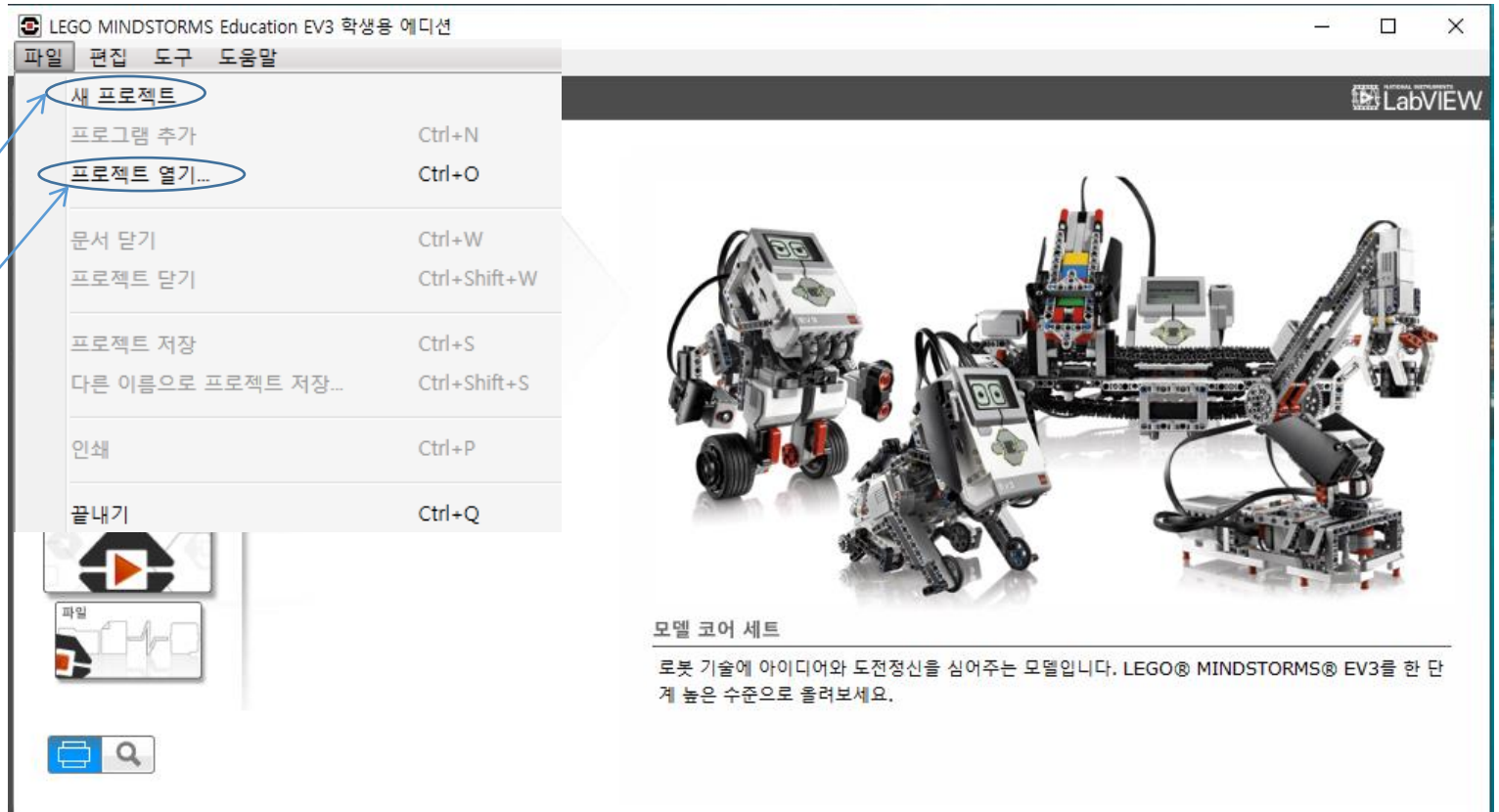
3. EV3 software control

EV3 software basic control

EV3 software practice

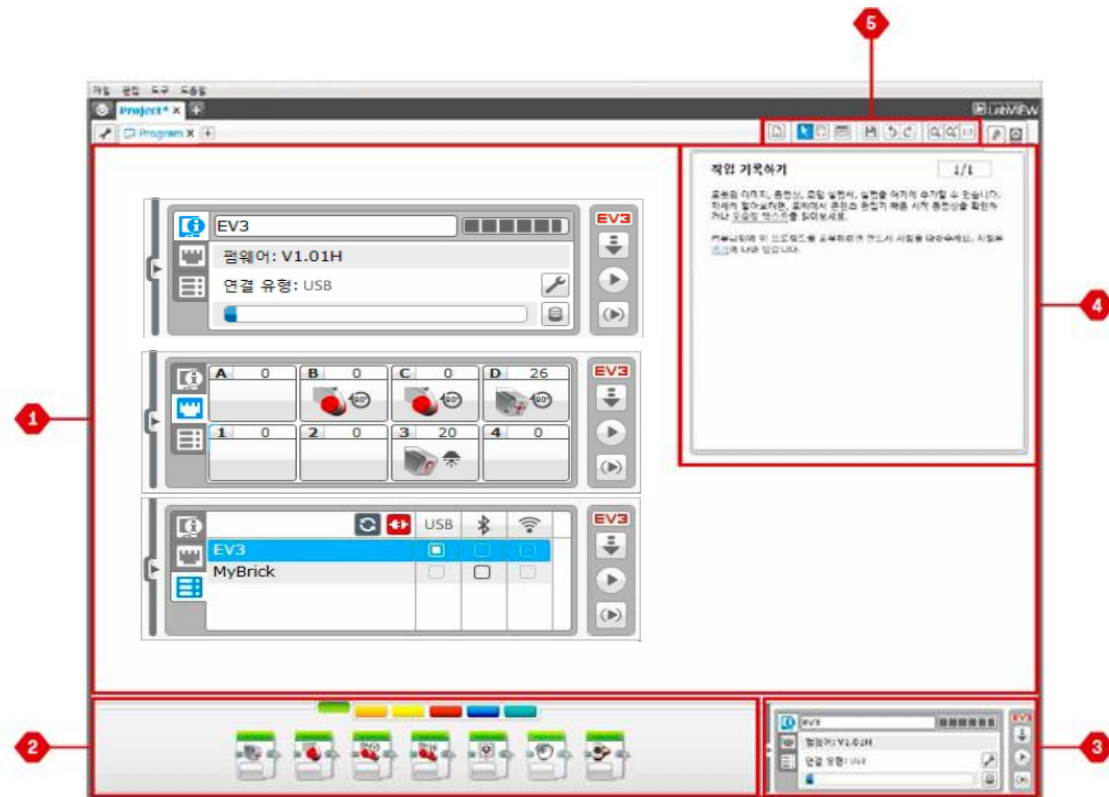
New project

Open project



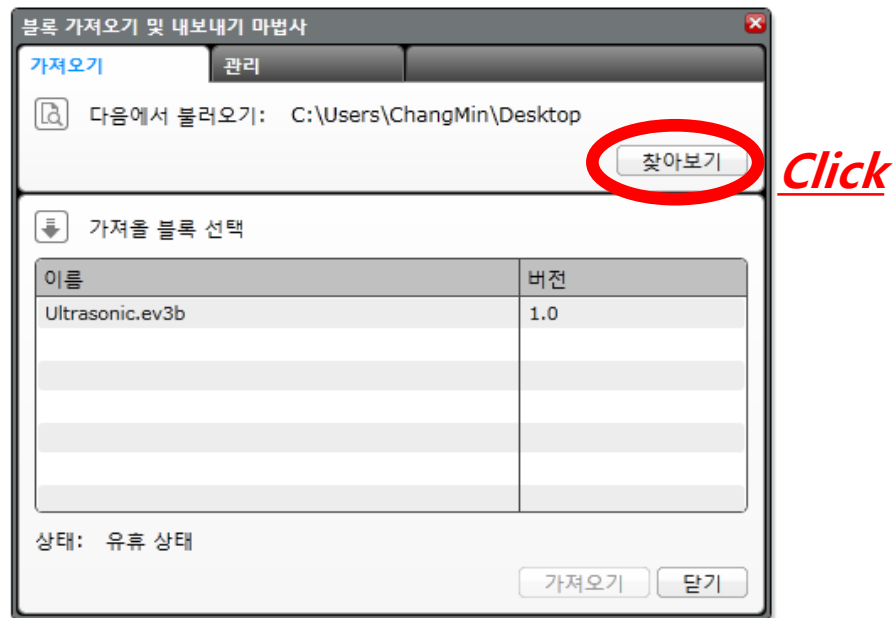
EV3 software editor

1. Canvas
 - coding
2. Palette
 - block
3. Hardware page
 - hardware connection display
4. Contents editor
 - working list
5. Programming tools
 - list, select, move, comment, save, run cancel
6. Program run



Menu > tools(도구) > bring block(블록 가져오기)

- Bring block
 - add ultrasonic wave , gyrocompass (for example)

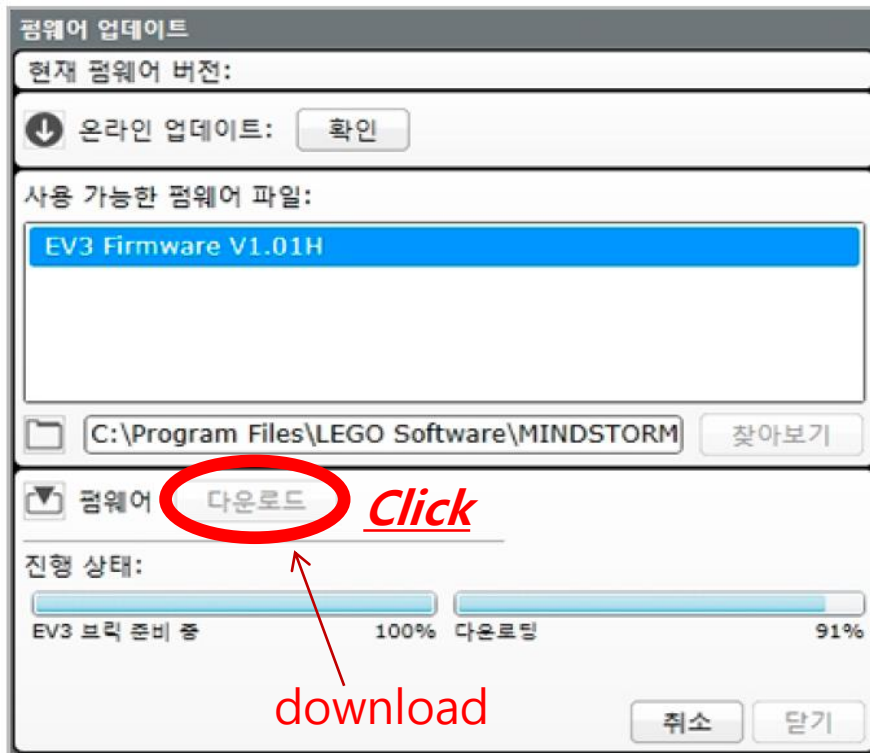


- Restart program after completion

Menu > tools(도구) > firmware update(펌웨어 업데이트)

- Firmware update
 - EV3 brick connection is required

USB connection to the computer is required



실패 시 (가이드 내 44쪽 참조)

펌웨어 업데이트 도중에 특정한 이유 때문에 EV3 브릭이 작동을 멈추면 다음과 같이 수동으로 업데이트해야 합니다. (이 때 EV3 브릭은 USB를 통해 컴퓨터에 연결되어 있어야 합니다.)

1. EV3 브릭의 뒤로, 가운데, 오른쪽 버튼을 길게 누릅니다.
2. EV3 브릭이 다시 시작되면 뒤로 버튼에서 손을 뗍니다.
3. "업데이트 중"이라는 메시지가 화면에 표시되면 가운데 및 오른쪽 버튼에서 손을 떼고, 펌웨어 업데이트 도구의 다운로드 버튼을 클릭합니다. 이제 펌웨어가 EV3 브릭으로 다운로드되며 자동으로 다시 시작됩니다.

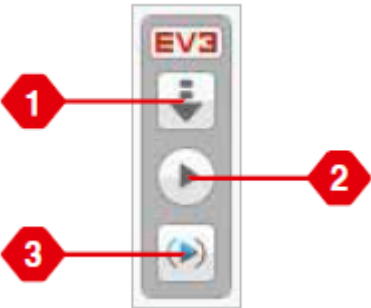
수동 펌웨어 업데이트 직후에 EV3 브릭이 작동하지 않으면 수동 업데이트 절차를 반복하세요.

Another functions in 'tools(도구)'

- Memory browser (메모리 브라우저)
 - Program explorer in EV3 brick
- Download into app (앱으로 다운로드)
 - Save program into EV3 brick
- Bring a program in the brick (브릭 프로그램 가져오기)
 - Bring a EV3 program in the brick

Program running

1. Run in the software



1. Download :
 - Download a program in the EV3 brick
2. Download & run :
 - Step 1 + run immediately
3. Download & select action :
 - Run and download into brick immediately only selected block

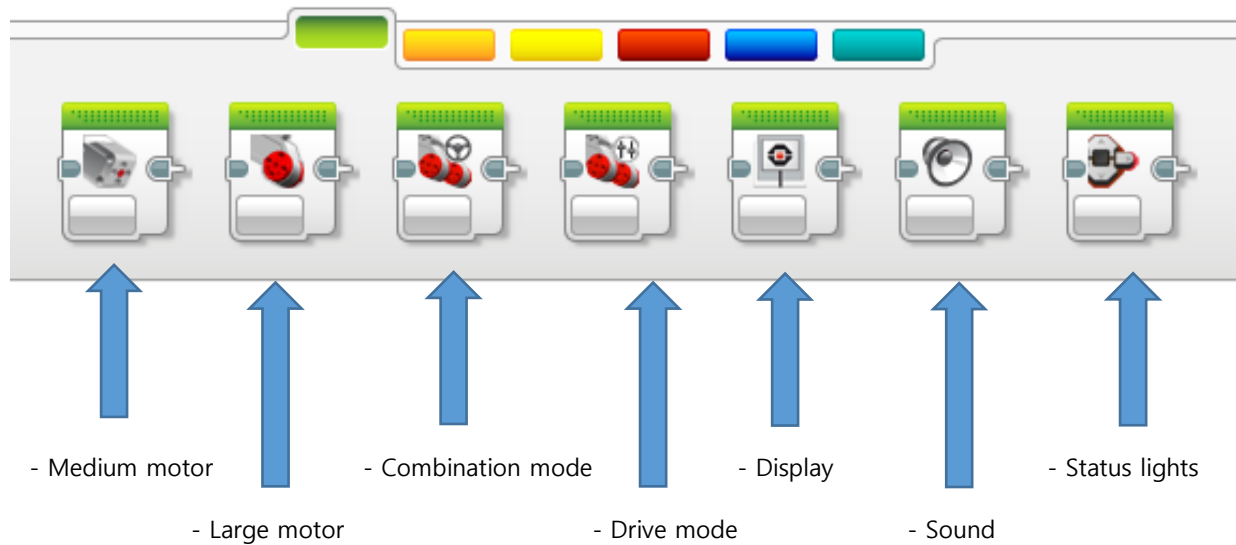
2. Run through the button on the brick

- A program saved in the brick can be run by clicking the button on the brick

4. Composition of block 'EV3'

1. Menu for Action
2. Flow Control
3. Sensor
4. Data operation
5. Premium
6. My Block

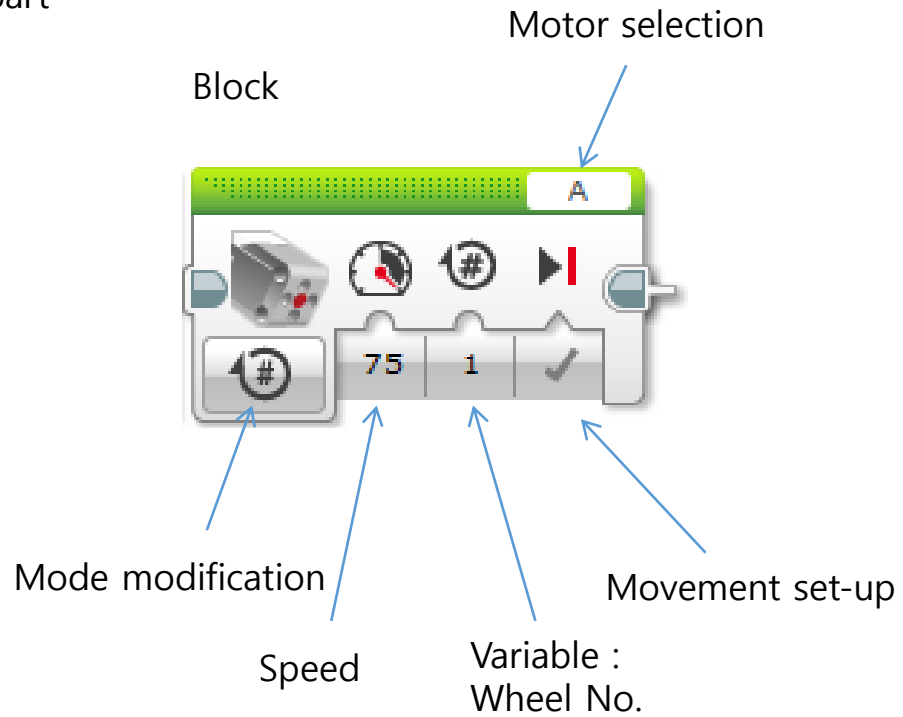
Menu for Action



Medium motor

Motor used in crane part

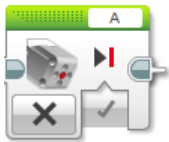
Medium
motor



Medium motor

- Mode explanation

Turn-off



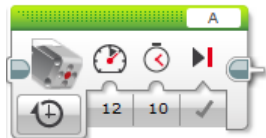
Motor doesn't work.

Turn-



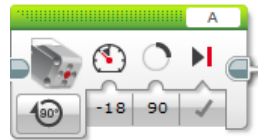
Motor will be operated by the designated speed (for a few times)

Operated by times



Motor will be operated by the designated speed with the number of **times that you indicated**

Operated by angle



Motor will be operated by an **angle that you designated** (ex. Speed : -18, Angle : 90)
Minus speed: backward movement

Operated by rotations of wheels



Motor will be operated by the number of **rotations that you designated** (ex. Speed : -18, rotations of wheels : 0.5)

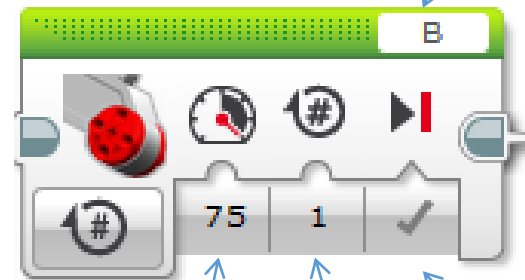
Large motor

Motor used in wheels

large motor



Block



Motor selection

Mode modification

Speed
(power)

Variable :
number of
rotations

Movement set-up

Full
power:
100

Large motor

- Mode explanation

Turn-off



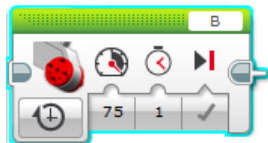
Motor doesn't work.

Turn-



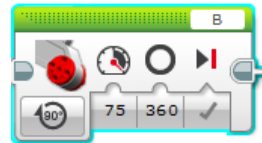
Motor will be operated by designated volume of force
(for few times)

Operated by times



Motor will be operated by designated force for **times that you designated**
(ex. Force : 12 for 10 sec)

Operated by angle



Motor will be operated by designated force and **angle that you designated**
(ex. Force: 75, Angle : 90)

Operated by accounts of wheels

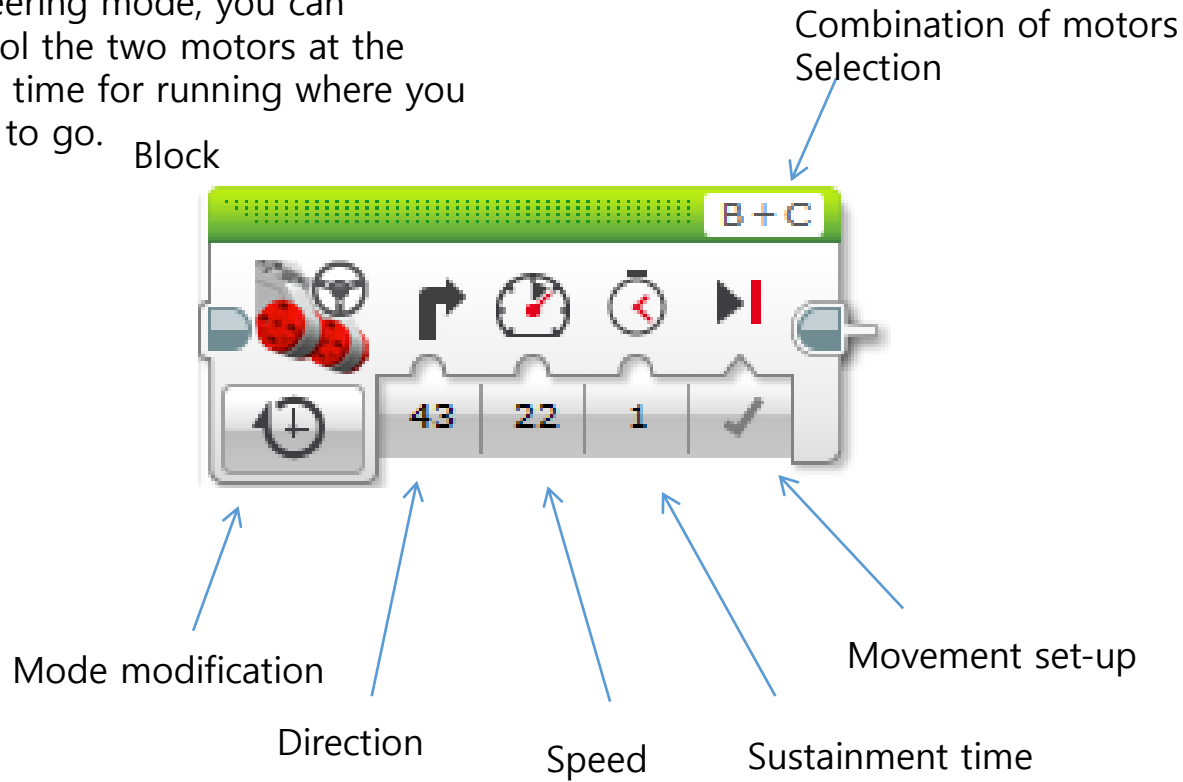


Motor will be operated by **accounts of wheels that you designated**
(ex. Force: 75, Account of wheels : 1)

Large motor(steering mode)

In steering mode, you can control the two motors at the same time for running where you want to go.

Block

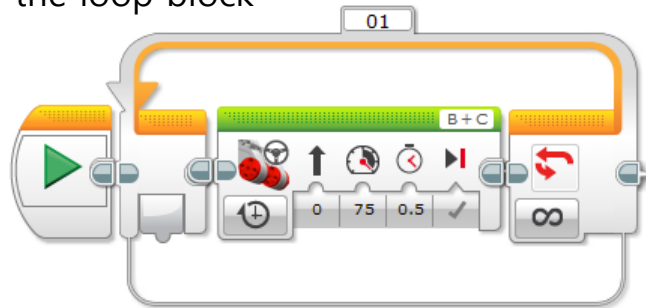


Steering mode examples

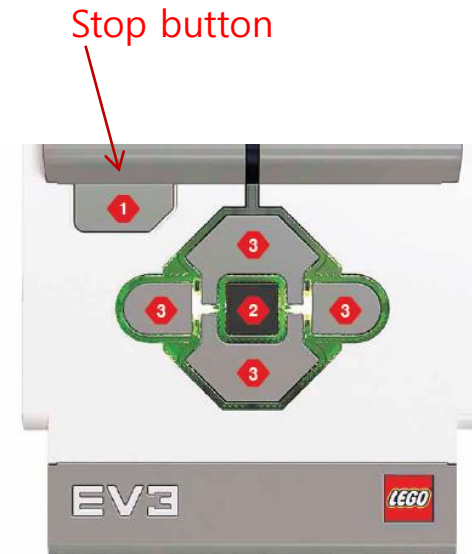
1. Choose the loop block and connect



2. Arrange the large motor(steering mode) in the loop block



3. Robot will drive straight until you stop the program

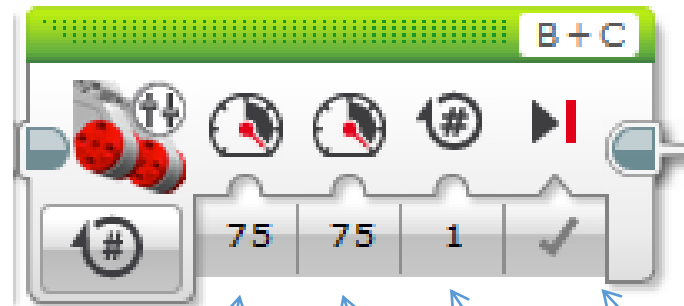


Large motor(Tank mode)

In tank mode, it controls each speed of two motors

Block

Select combination of motors



Mode modification

Speed of Right wheel

Movement set-up

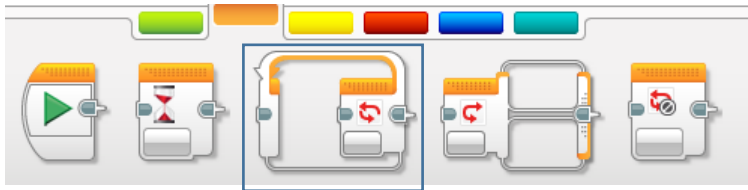
Speed of Left wheel

Duration (rotations)

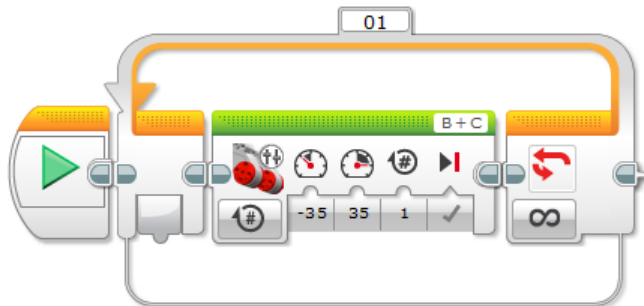
this block will make the robot move one wheel rotation forwards in a straight line.

Tank mode examples

1. Choose the loop block and connect



2. Arrange the tank motor (steering mode) in the loop block

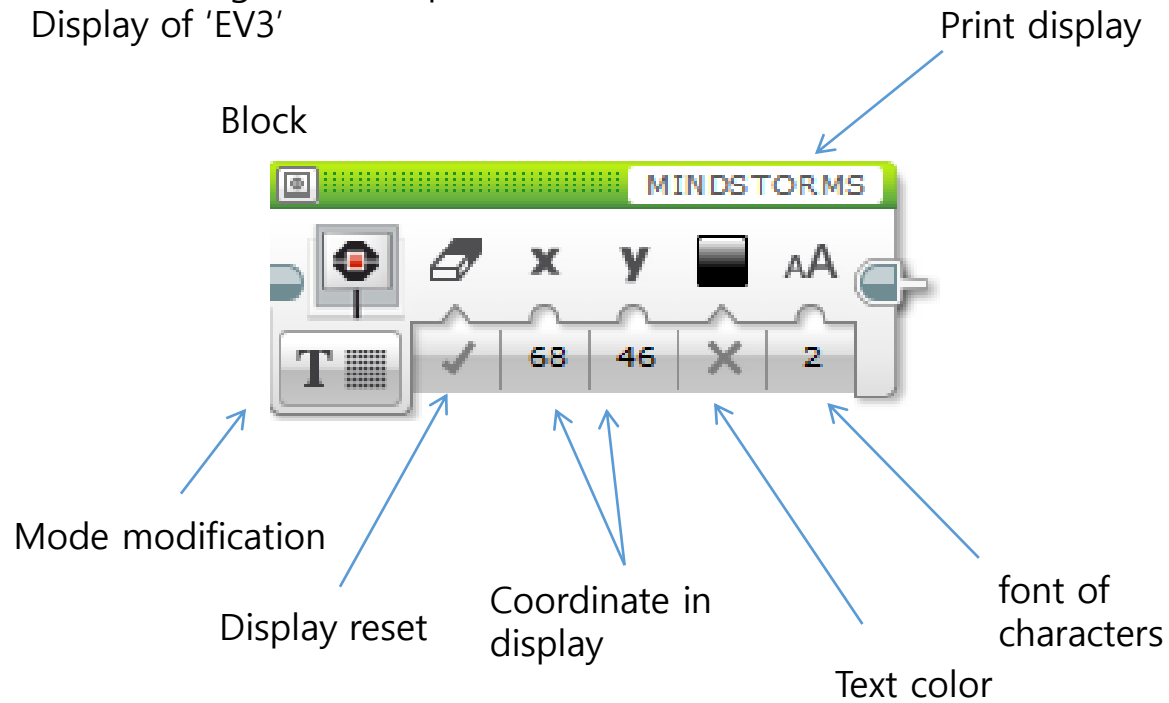


3. Setup the speed of both wheels as -35,35

4. Check if the robot rotates

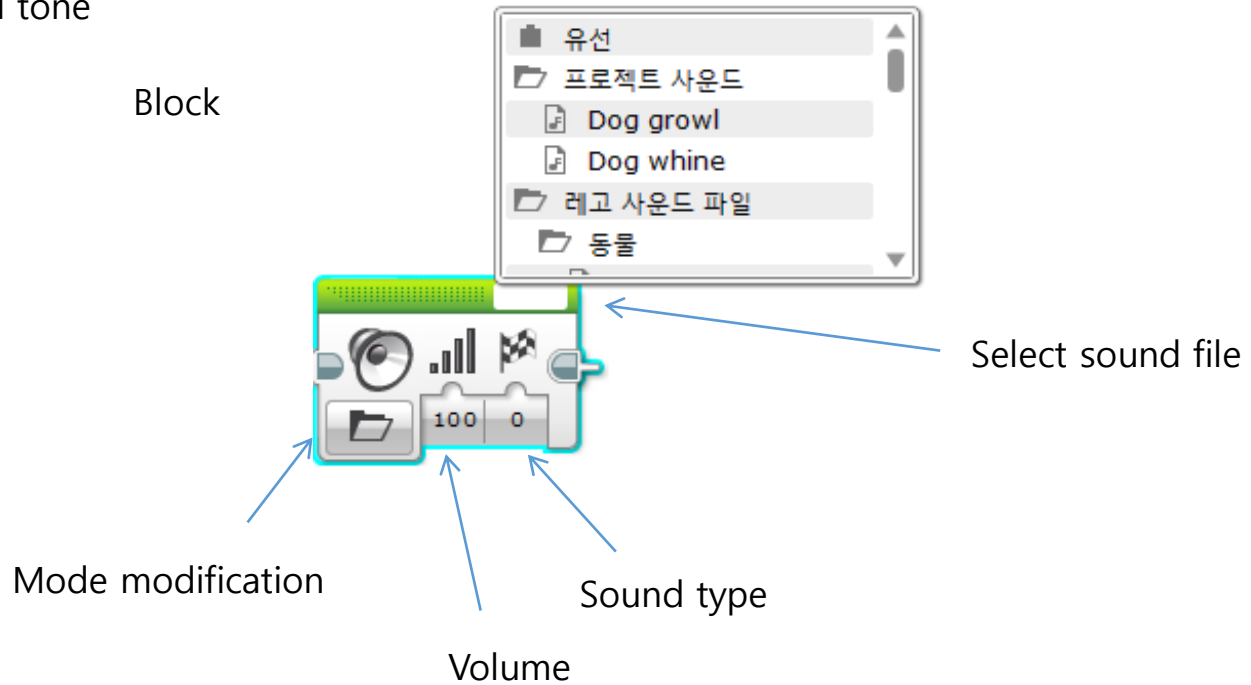
Display

Print an image, text, shape in the Display of 'EV3'

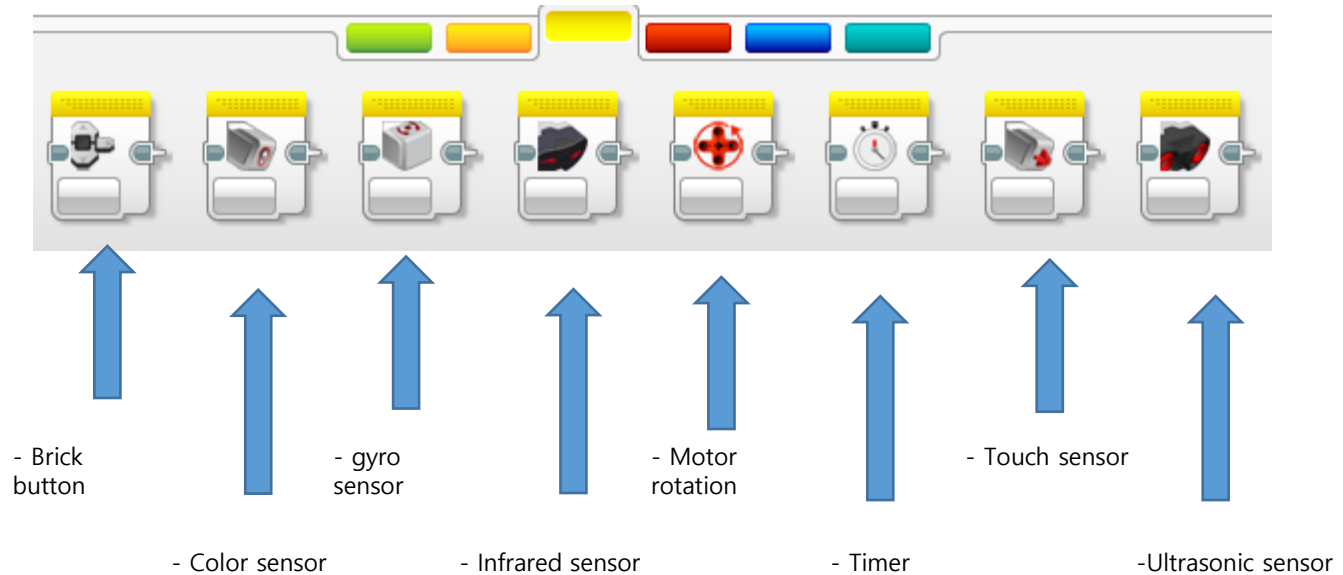


Sound Out-put

Turn on the sound file, single sound and tone



Sensor menu



Color sensor



Measurement(측정)

Comparison(비교)

Revision(보정)

This digital sensor can sense the color and intensity of lights
You can measure the color and reflected light, ambient lights

Color(색상)

Intensity of reflected lights(반사광 강도)

Intensity of ambient lights(주변광 강도)

Color mode(hue mode)

It can figure out the colors (Black, Blue, Green, Yellow, Red, White, Brown)



outputs in this part

Output
 0 : no color
 1 : black
 2: blue
 3: green
 4: yellow
 5: red
 6: white
 7: brown

In-put(입력)

Type(유형)

Allowable value(허용값)

Reference(비고)

입력	유형	허용값	비고
색상 모음	숫자형 배열	각 원소: 0 - 7	비교 - 색상 모드에서 테스트하려고 선택한 색상: 0 = 색상 없음 1 = 검정 2 = 파랑 3 = 초록 4 = 노랑 5 = 빨강 6 = 흰색 7 = 갈색

Out-put value

Color sensor

- Intensity of reflected light mode
- It can measure the intensity of reflected lights (0: dark, 100 : white)

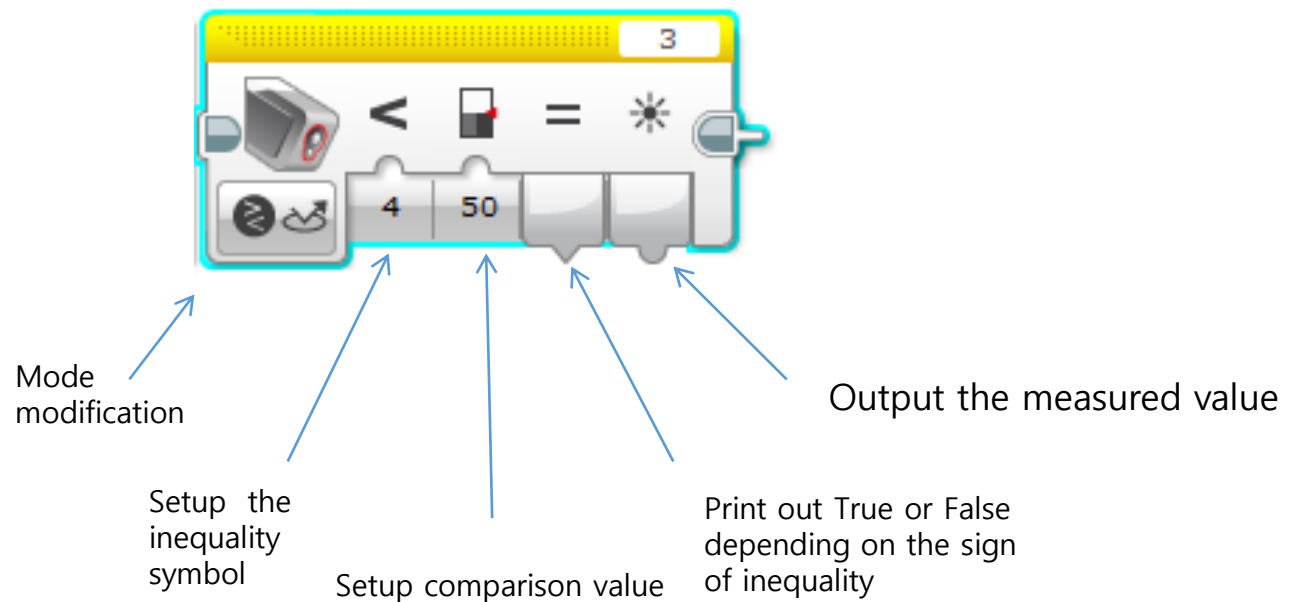


- Intensity of ambient light mode
- It can measure the intensity of lights



Color sensor (Comparison value mode)

It can distinguish if the measured value is larger than the designated value

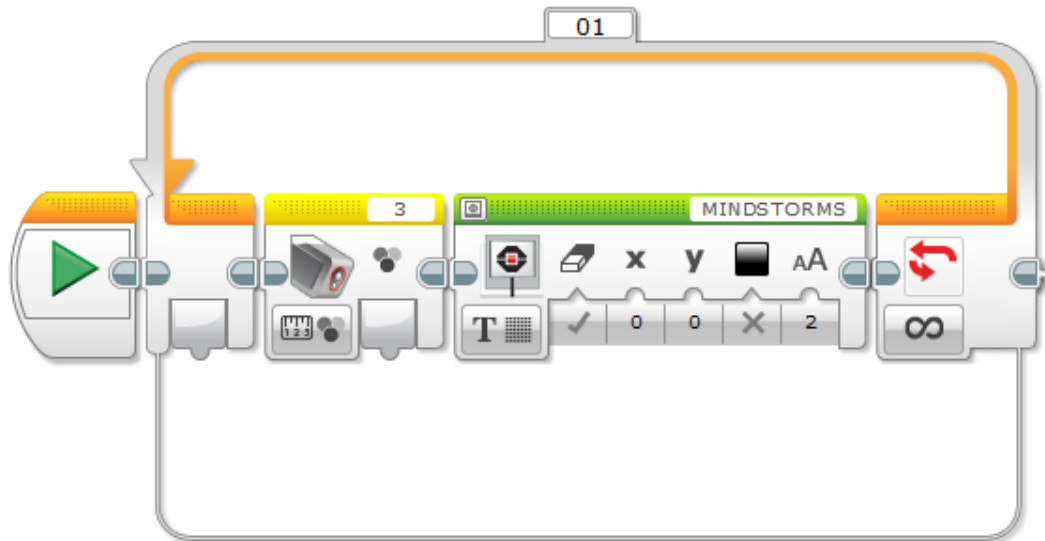


Color mode examples

1. Choose the loop block and connect

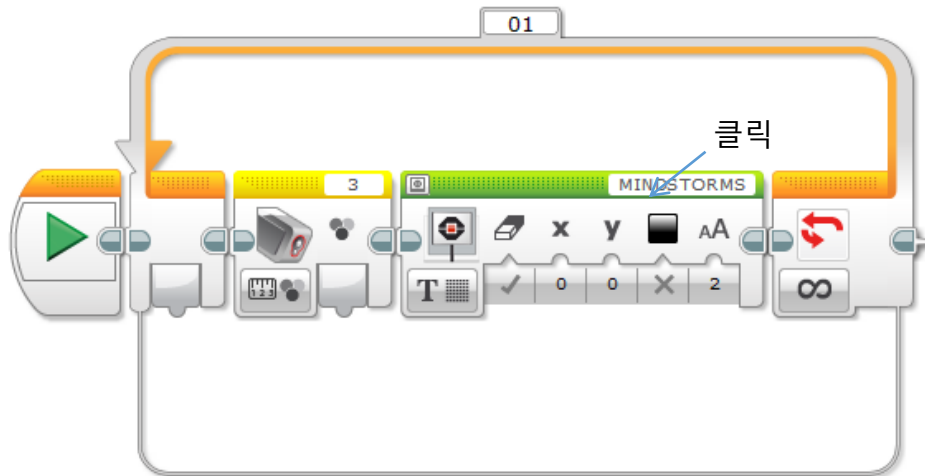


2. Arrange the color sensor and display block in the loop block
Display block : text output mode



Color mode examples

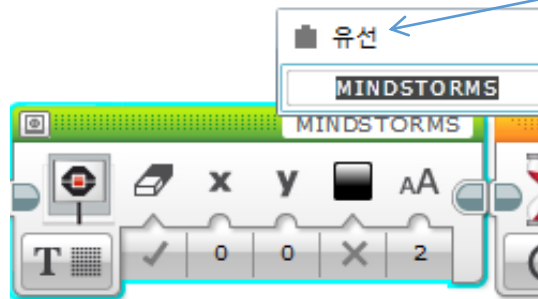
3. Click the text input section



4. Select cable(유선)

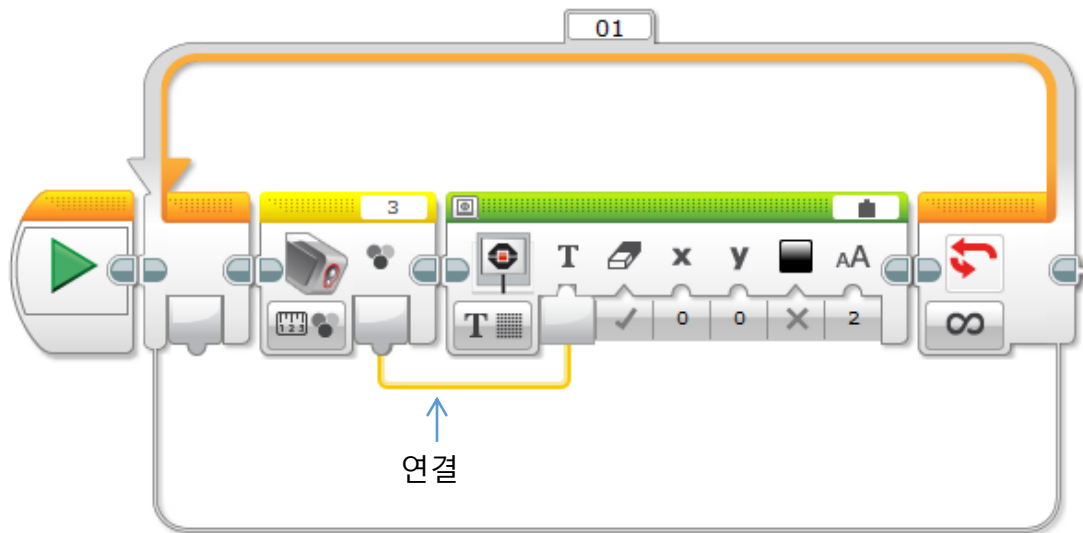
Select cable (it can output the value.)

cable(유선)



Color mode examples

5. Connect the input terminal of value in display block to the output terminal of value in color sensor

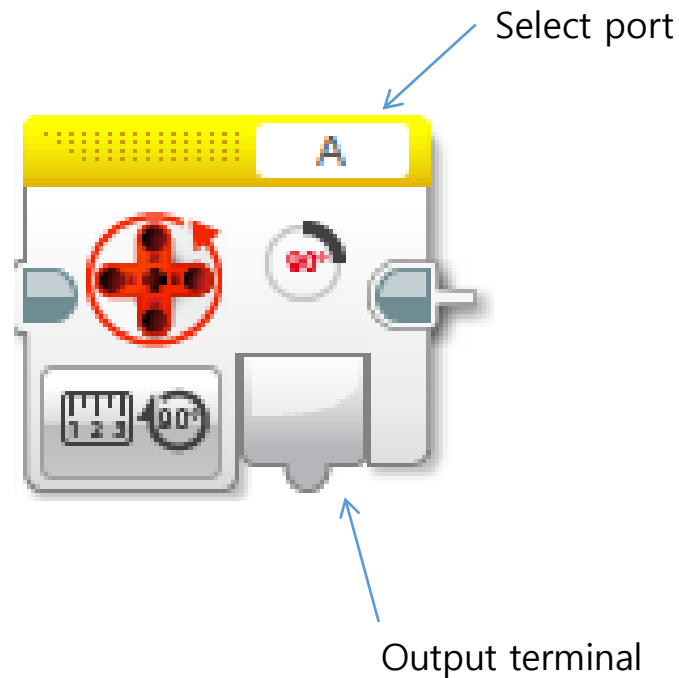


6. After running, measure various colors

7. Try it again by using the ambient lights and reflected lights mode

Motor Rotation

- It can measure the value and speed of motor rotations
- The value of output will print the type of angle and number of rotations (depending on mode) in the selected motor



Touch sensor

Print the status of touch sensor button



Select sensor
port

Output information

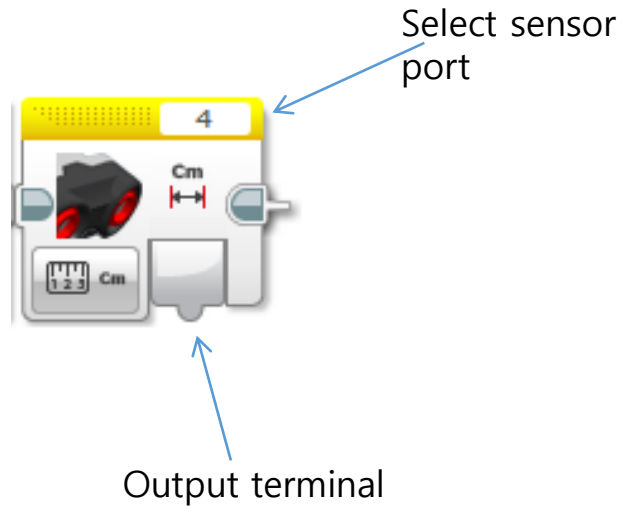
유형: 숫자
허용값: 0 - 2
비고: 비교 모드에서 테스트하는
상태.
0 = 눌리지 않음
1 = 눌림
2 = 접촉 후 떨어짐

Type(유형) : Number(숫자)
Allowable value(허용값) : 0-2
Note : test status in comparison
mode
0 = Not press
1 = press
2 = after touch , falling

Output terminal

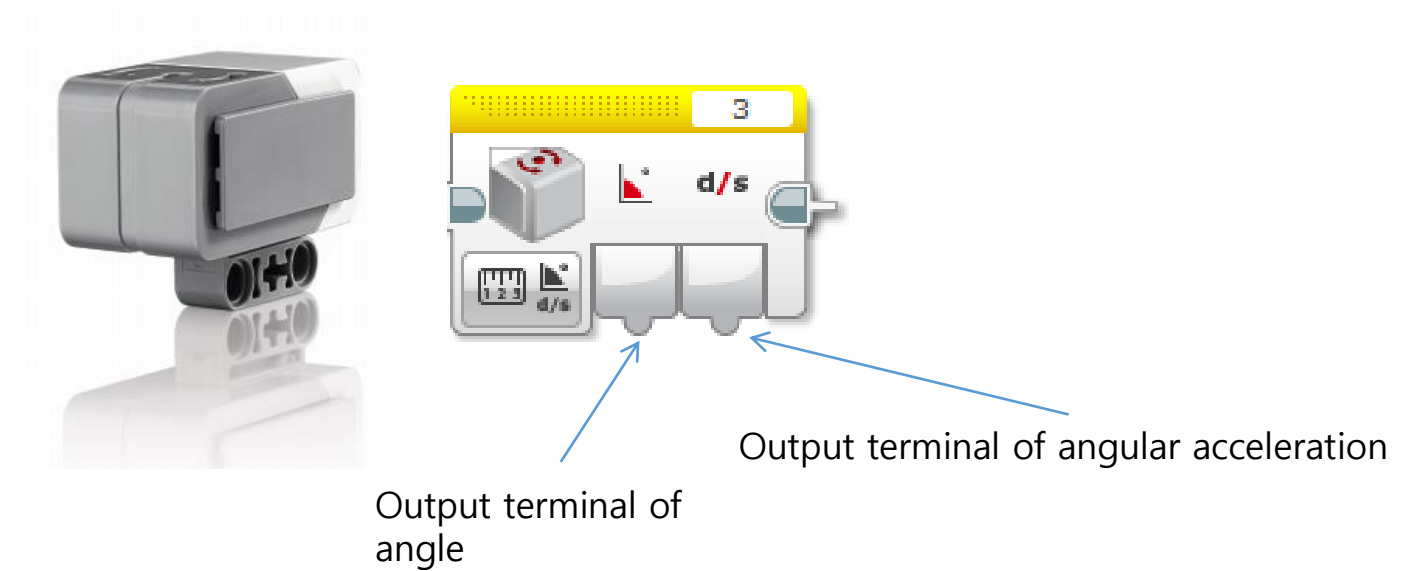
Ultrasonic sensor

Print the distance to the object in centimeters or inches
(depending on the mode)

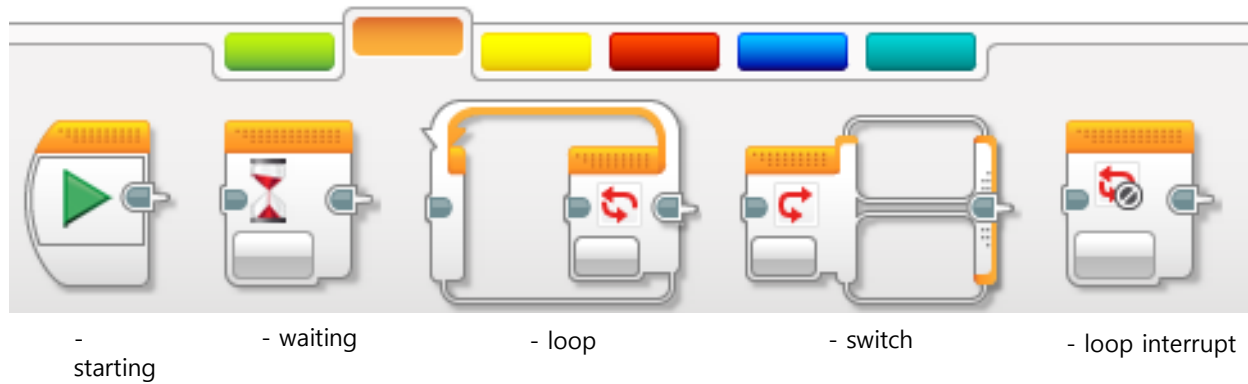


Gyro sensor

- Print the direction of sensor in degrees
- Print the angle and angular acceleration



Flow control menu



Starting and Waiting

Start block

- Display the starting of block sequence
- The program can include one or more sequences
- When the program starts, the sequences all start at the same time



Waiting block

- The program will be waiting for a period of time or until certain conditions are satisfied (depending on mode)



Waiting for a given amount of time (1 second)



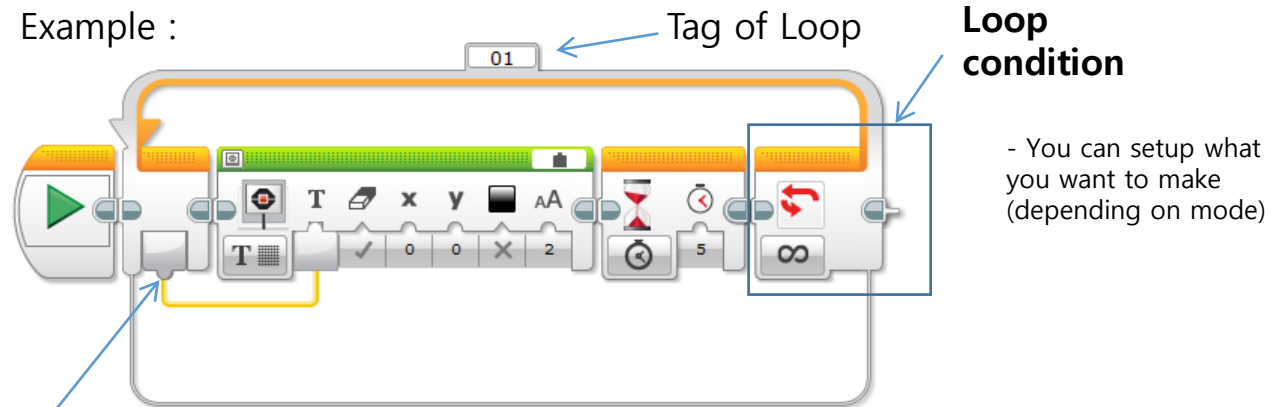
Waiting for the ultrasonic sensor to have a value of less than 50cm

Loop

- Loop

Repeat the inner block until the condition is satisfied

Example :



Print number of loop

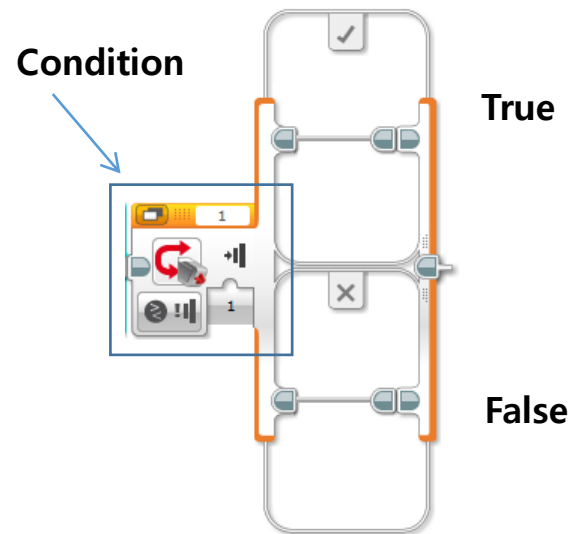
If you run this program, the number is displayed on the screen, which increases by 1 every 5 seconds (starts from 0 sec)

Switch block

- If

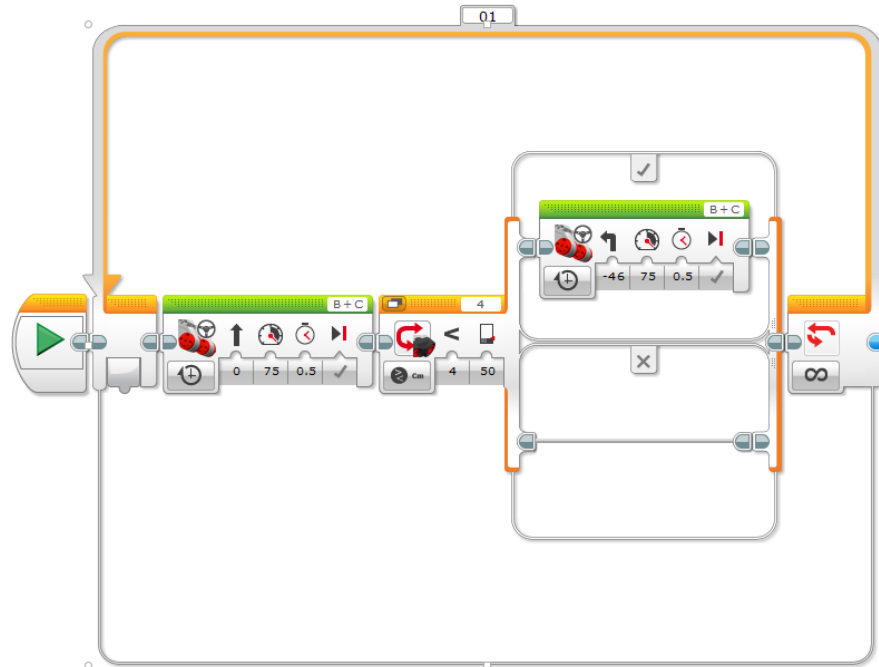
If the condition is satisfied (**True**) , the upper program will start

If the condition is not satisfied (**False**) , the under program will start



Control block example

If any obstacle comes in a distance of 50cm while the robot is moving forward, it will rotate to the left (Obstacle avoidance algorithm)



Optional Exercise

Let's make a program with which the robot moves backwards (180degree) or rotates by 180 degrees to avoid an obstacle, when it meets the obstacle while moving forward.

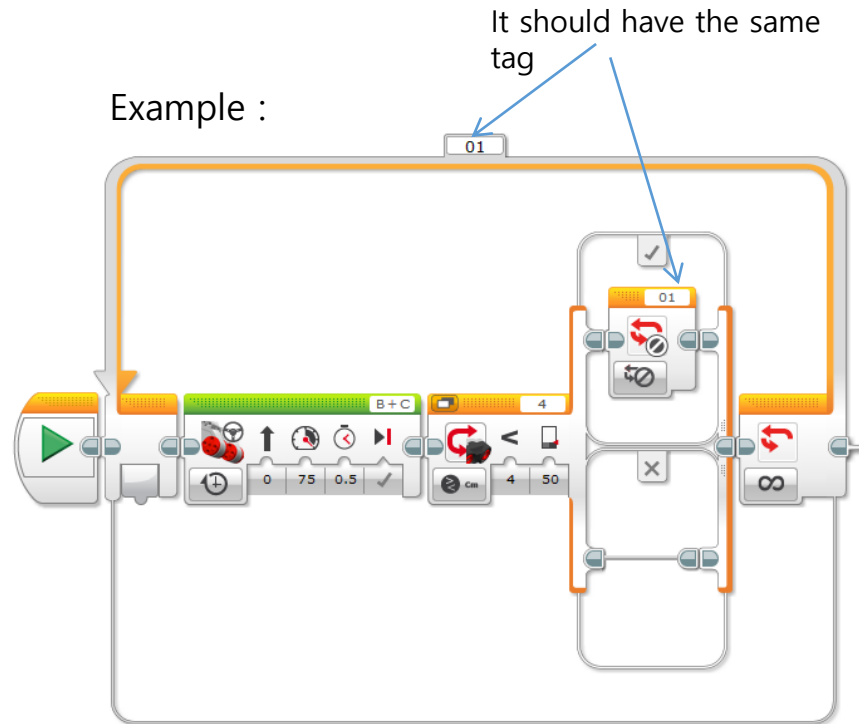
Loop interrupt

- Break



To exit the loop with a tag such as this one.

Example :



While moving forward, stop when the robot sees an obstacle

5. EV3 execution example

EV3 program of basis

Sound generation according to the color input

Program to tell what color is the input color.
Generate sound depending on the input color

There is a sound file for each color.
By using a color sensor, which reads an input color.

Fig1. Path of sound file.

레고 사운드 파일-> 색상

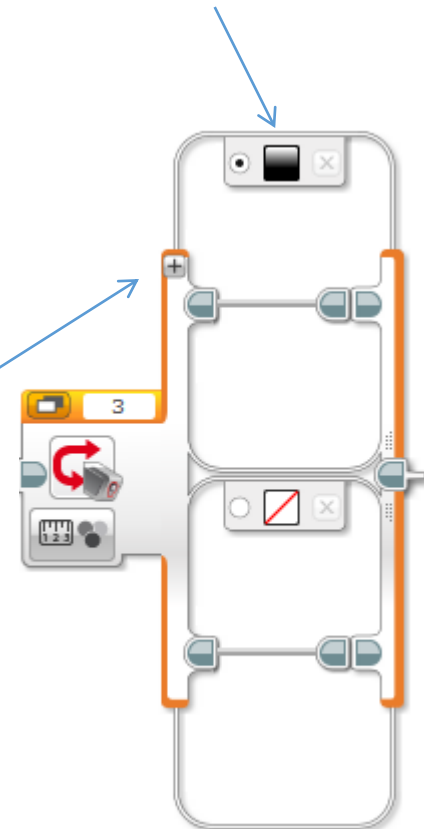


Fig2. A way to adding case

If you set the condition on the switch block to the color, it is possible to increase the number of cases of conditions.

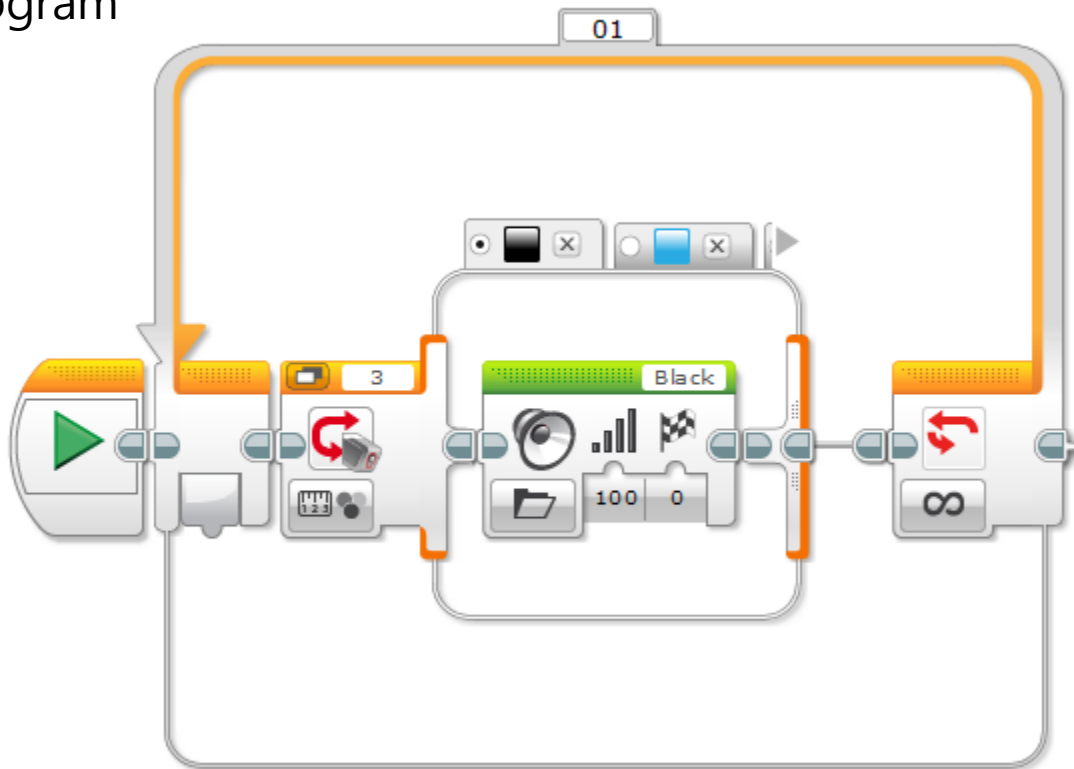
케이스 추가 버튼
Add button

케이스 설정
Condition Setting



Sound generation according to the color input

Program

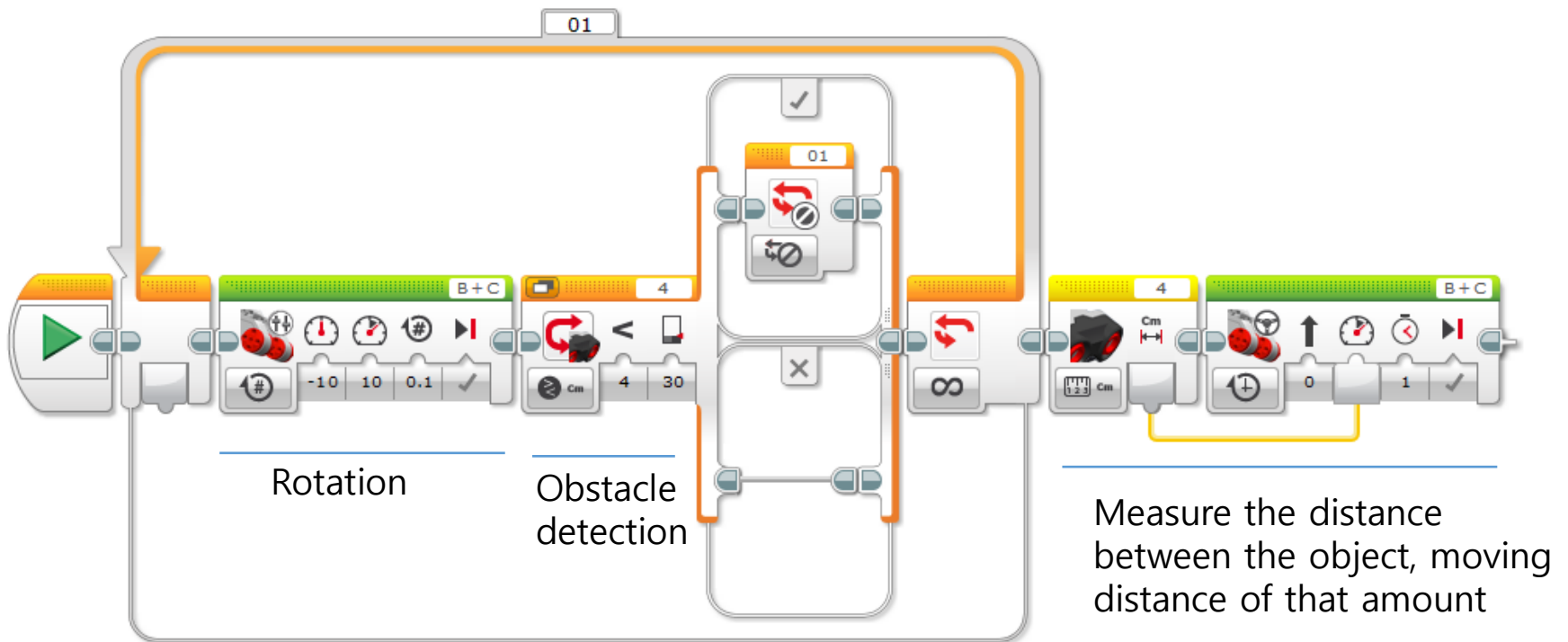


Optional Exercise

By applying the above program, let's create a program. The robot moves forward and if black color comes in, the robot is rotated in a fixed position.

Obstacle detection and access

Rotate counterclockwise at a predetermined position.
if there is an object nearby, stop rotating

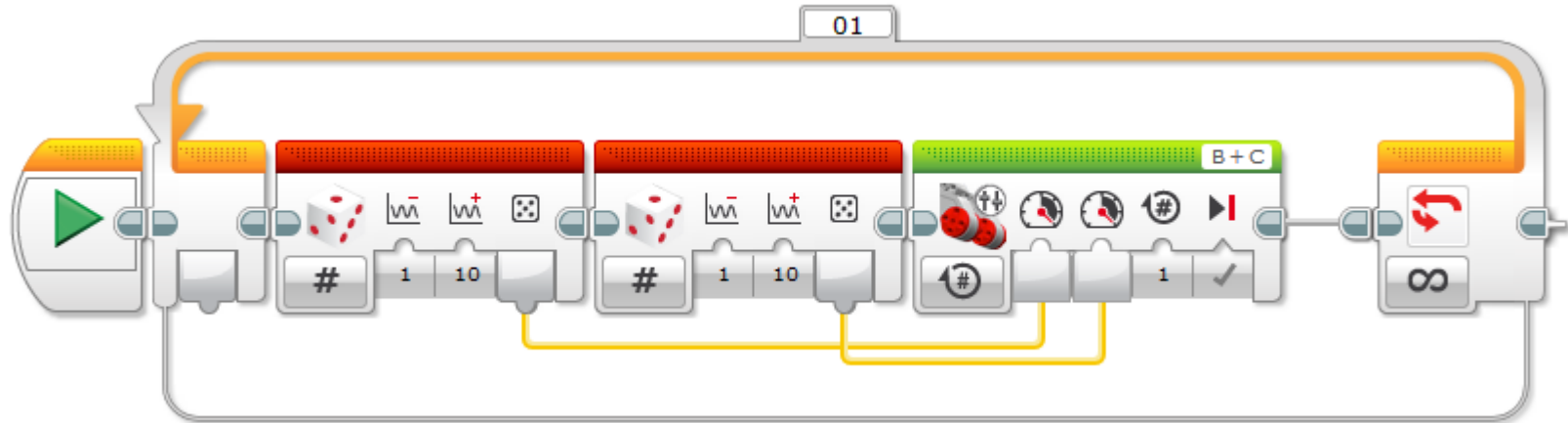
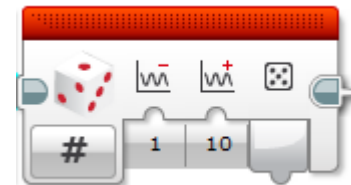


Optional Exercise ?

Random movements

A Program for randomly-moving robot.

There is a block for generating a random number in the data operation tab. Let's make it randomly move the robot using this tab.



Optional Exercise

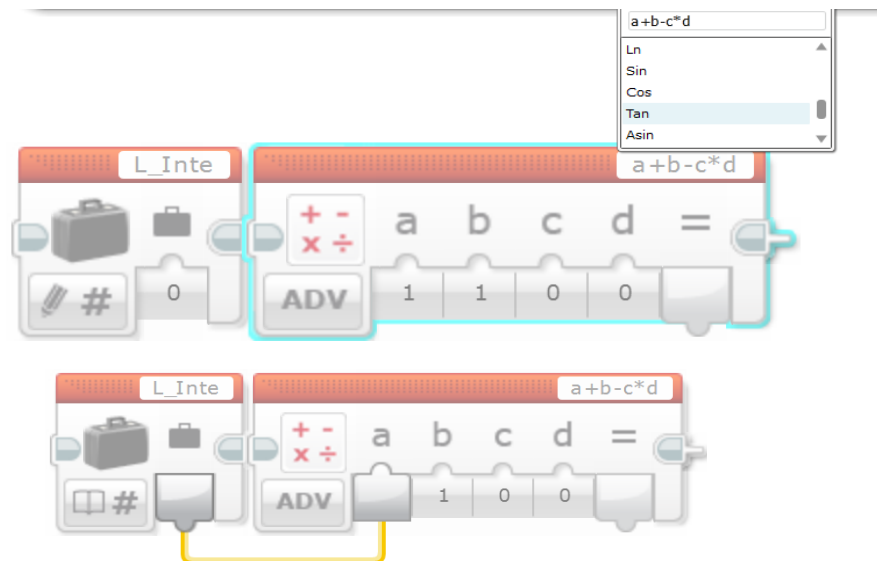
- Start random movement, but stop when it encounters an obstacle.

Sound generation according to the distance

- Write a program to make a sound in accordance with the accumulated value from L/R motor.
- Write a program to change the frequency depending on the cumulative moving distance.
- Only the consideration of rotation.

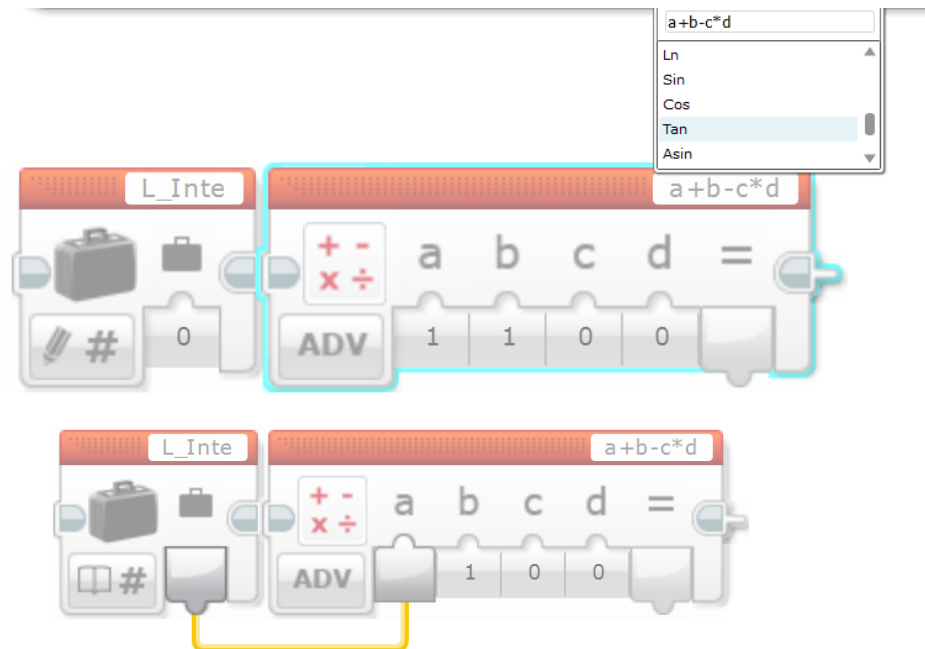
Sound generation according to the distance

- Ref : Usage a variable and process.
 - Using a variable block, you can define a variable and operation like a sin / cos.
 - In the operation block, change it to ADV you can use 'Trigonometric functions'.



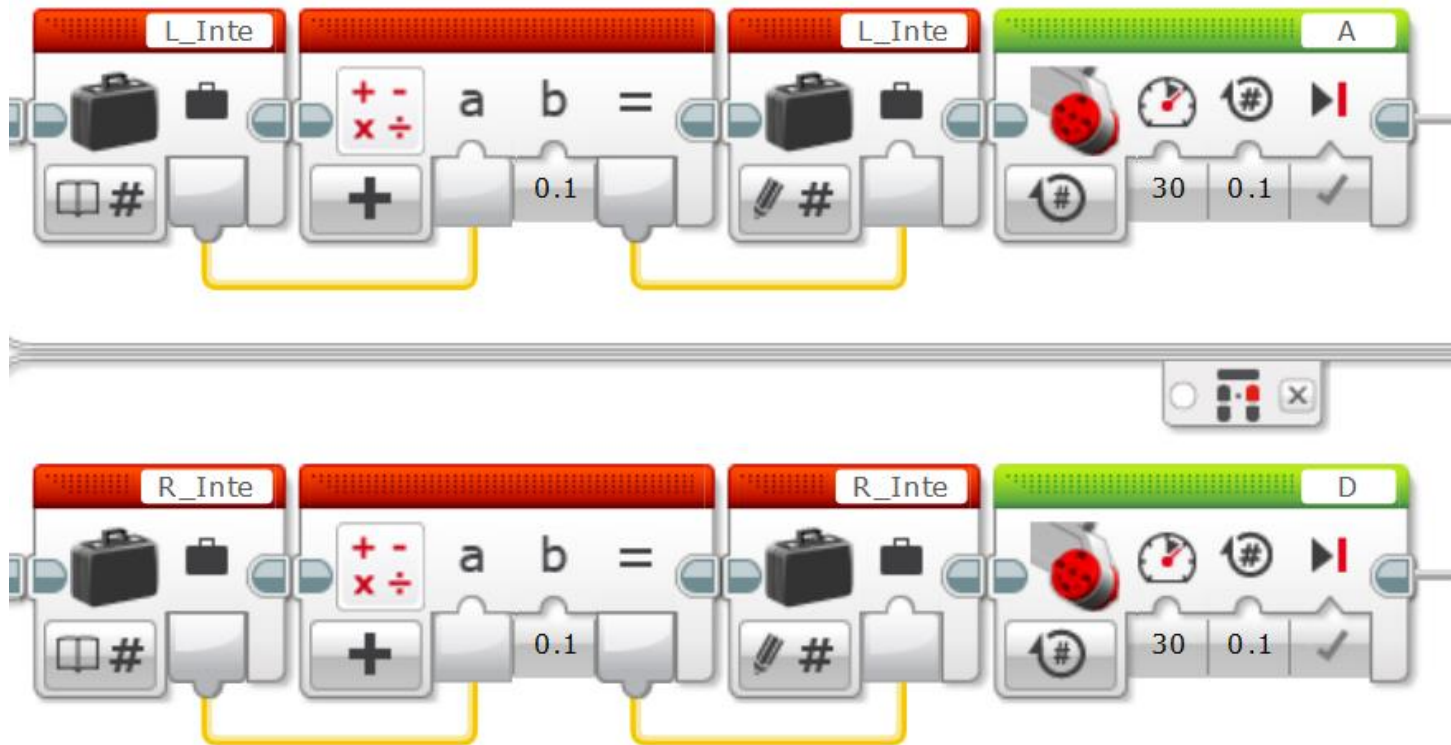
Sound generation according to the distance

- Ref : Usage a variable and process.
 - You can use variable by connecting a wire 'output – to – input'



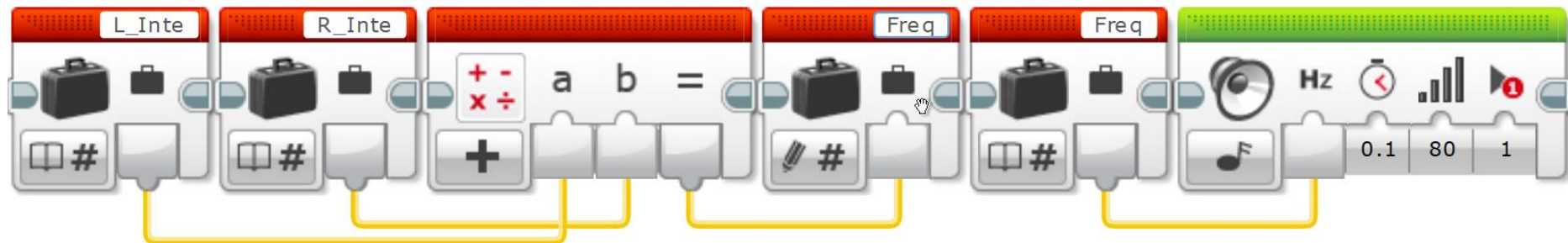
Sound generation according to the distance

- Program
 - Counting rotation of motor.



Sound generation according to the distance

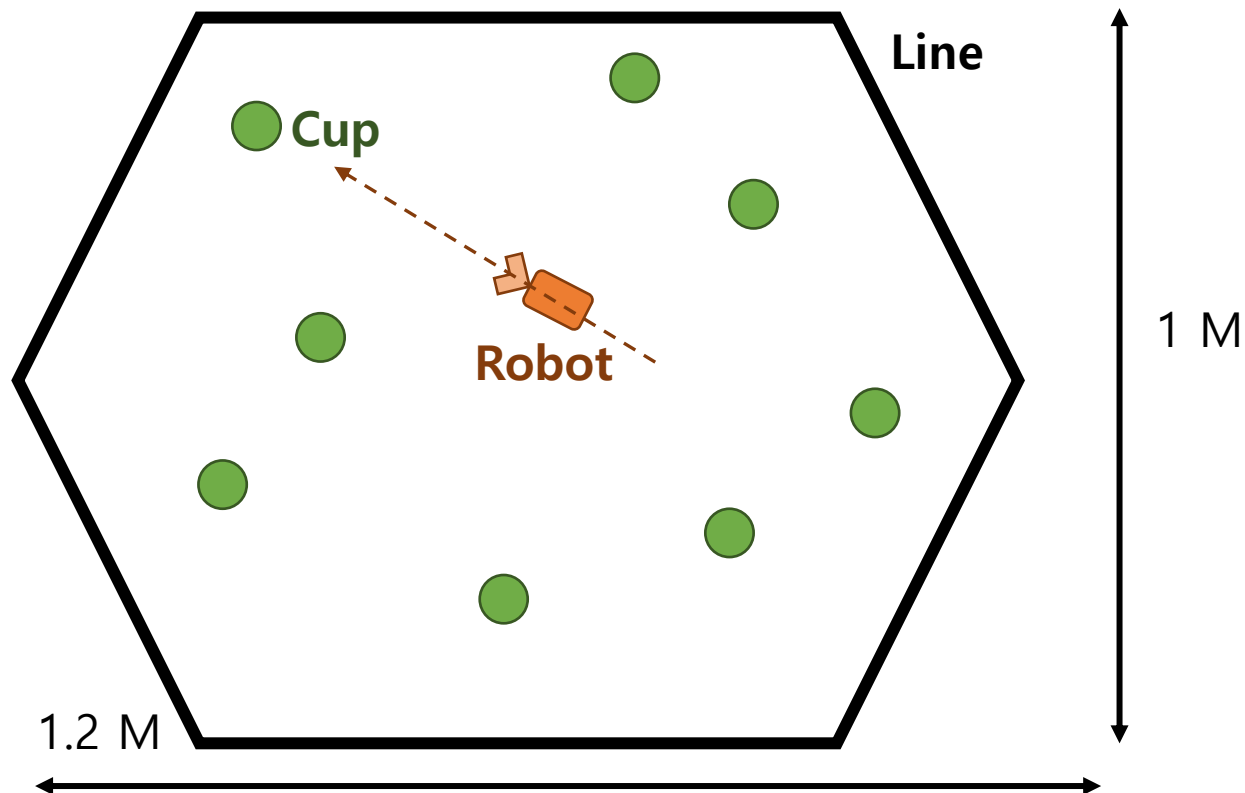
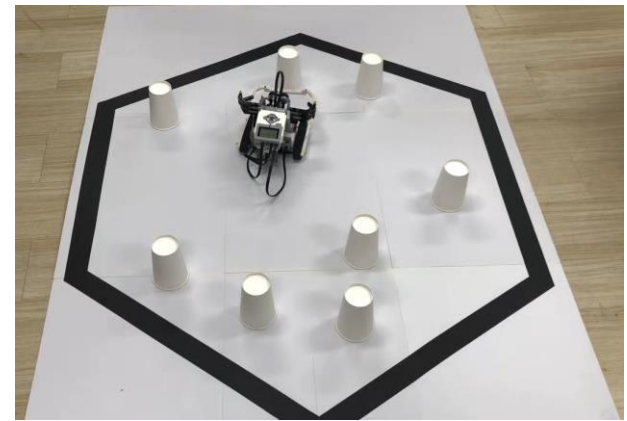
- Program
 - Determine the frequency using cumulative rotations



6. LEGO exam task

Task 1. Cup pushing

- Mission
 - Do not get out the hexagon line
 - Push the caps until it gets out of the hexagon line



Task 1. Cup pushing

- Mission
 - Time : 2 min 30s x 3 chances
 - The number of cups in the line : 8
 - The color of line : Black

Task 1. Cup pushing

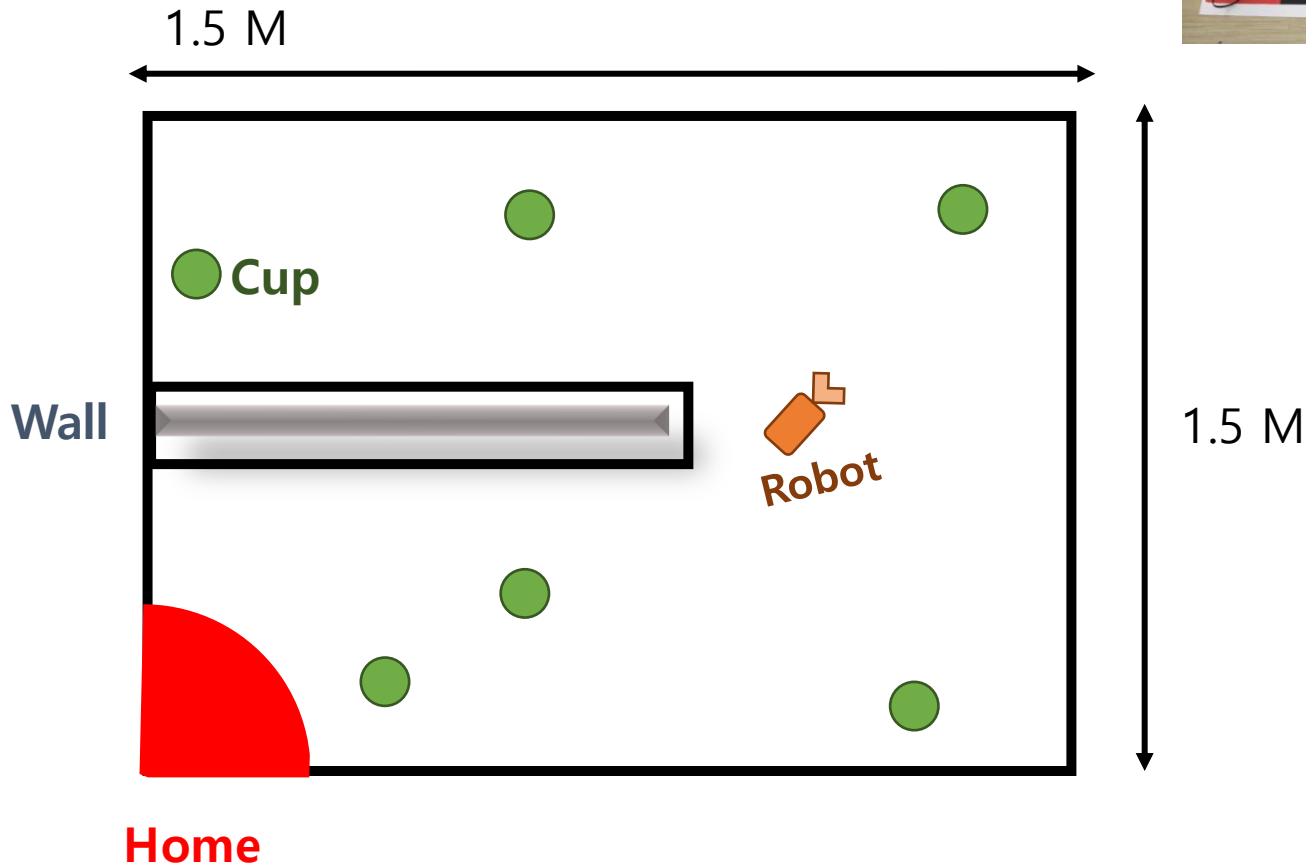
- Scoring criterion

1. Is the robot in the line on the running?
2. At the end, if all the cups were extruded to the outside?
3. Whether it pushes the cups to the middle of space
4. Whether it pushes the cups to the outside of space
5. How much recognition level of the object ?

Task 2. Cup gathering

- Mission

- Do not get out the rectangle line.
- Do not touch the wall
- Gathering cups to home.



Task 2. Cup gathering

- Mission.
 - Time : 10 minutes x 2 chances
 - The number of cups in the line : 6
 - if you gather the cup which is behind the wall, you will get extra credit
 - Line color : Black
 - Home color : Red

Task 2. Cup gathering

- Scoring criterion

1. Is the robot in the line on the running?
2. At the end, how many cups are gathered?
3. Whether it collect the cup which is behind the wall
4. Whether it distinguish with the wall and cup
5. How much recognition level of the object ?