

The Education University of Hong Kong
2022-2023 Quality Education Fund Thematic Network - Tertiary Institutes
STEM Project Team



SCHOOL: Sha Tin Methodist Primary School (P.3)



TOPIC: Cold Insulation Test

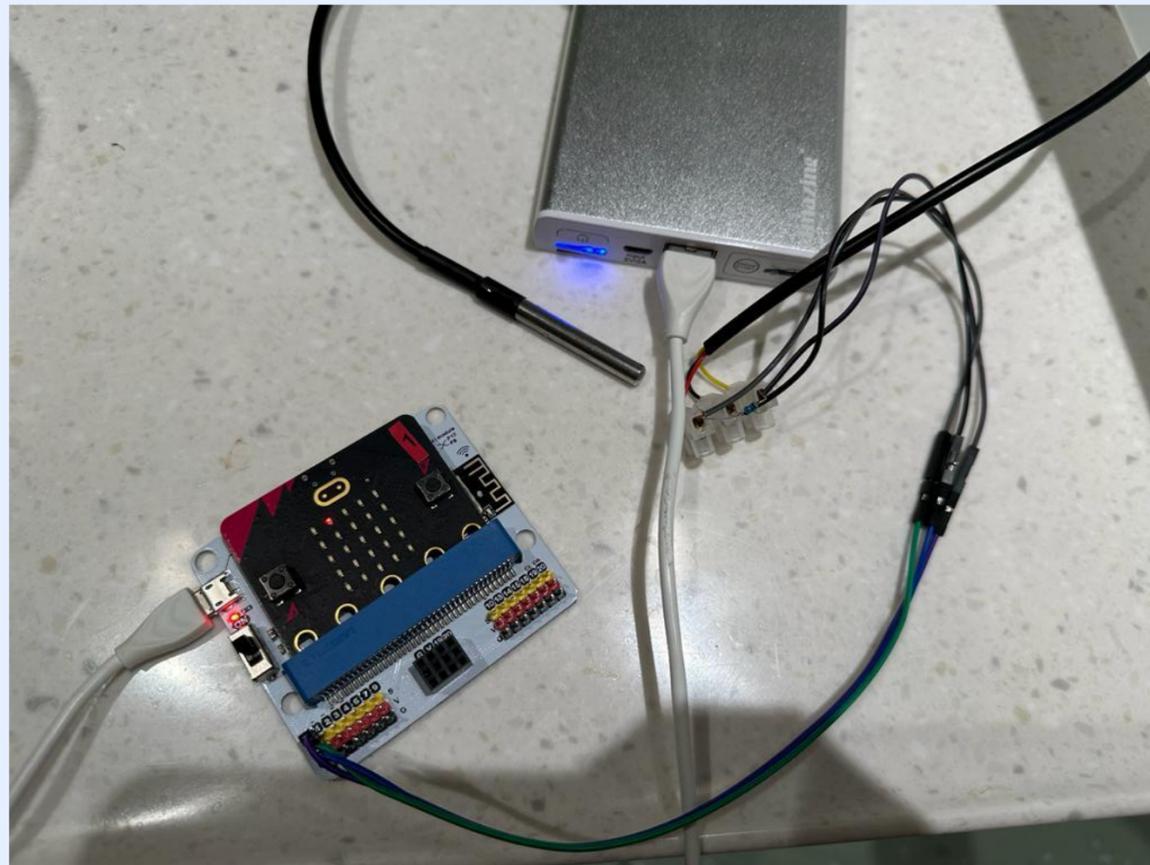
Experiment 1-Temperature test



Objective of Experiment

- Use Micro:bit and DS18B20 temperature sensor to test which material is most suitable for cold insulation.

Experiment material



Micro:bit, IoT board and DS18B20 temperature sensor



Stainless Steel Cup, Glass Cup and Styrofoam Cup



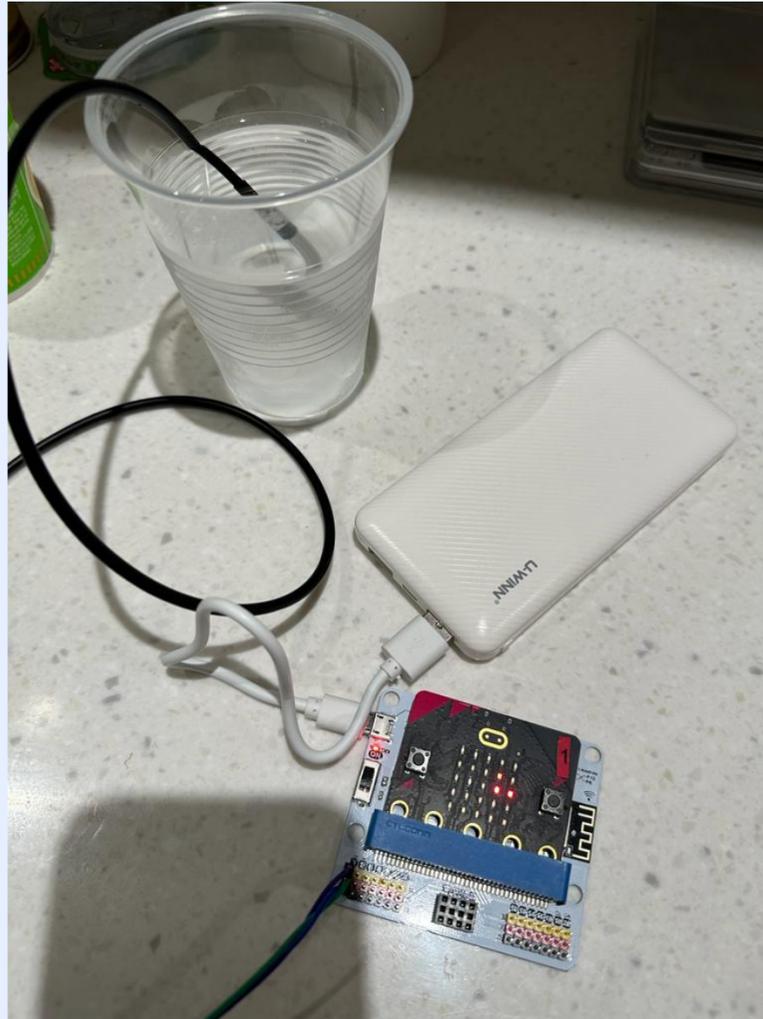
Measuring cup and Cold water

Coding

```
on start
  set ESP8266 RX P8 TX P12 Baud rate 115200
  connect Wifi SSID = "IoT" KEY = "eduhk+IoT+2018"
  if Wifi connected true then
    show icon [grid icon]
  +

forever
  connect thingspeak
  set data to send ThingSpeak
  Write API key = "ZR52JF8F4GL49A3U"
  Field 1 = temperature (°C) on P1
  +
  Upload data to ThingSpeak
  show number temperature (°C) on P1
```

Experiment

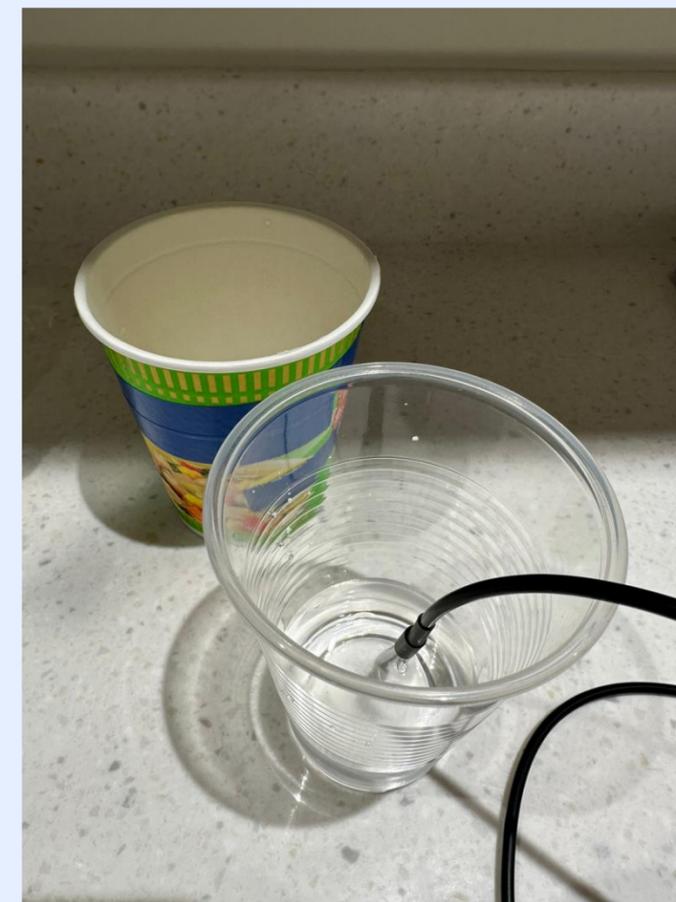


Temperature of the cold water: 5°C

Pour one glass of 5°C water into three different materials of cups equally. After ten minutes, pour the water out and measure the temperature change.

Experiment

 10 minutes later.....



Water insulated with:

Stainless Steel Cup:
9.38°C



Glass Cup: 13.31°C

Styrofoam Cup:
11.25°C

Result

Temperature of the original cold water: 5°C

Water insulated with:	Temperature changed after 10 minutes:
Styrofoam Cup	9.38°C
Stainless Steel Cup	11.25°C
Glass Cup	13.31°C

Radio

```
on start
  radio set group 5
  set ESP8266 RX P8 TX P12 Baud rate 115200
  connect Wifi SSID = "IoT" KEY = "eduhk+IoT+2018"
  if Wifi connected true then
    show icon [wifi icon]
```

```
forever
  connect thingspeak
  set data to send ThingSpeak
  Write API key = "V6H7K6STYNPXVIUS"
  Field 1 = value of DS18B20 P1 at pin temperature(°C)
  Upload data to ThingSpeak
  radio send number value of DS18B20 P1 at pin temperature(°C)
```

```
on start
  radio set group 5
  on radio received receivedNumber
    show number receivedNumber
```

Temperature Test



original temperature:
20.2°C and 20.6°C



when 20g ice added on the cup:
19.2°C and 16.5°C



	after 15 minutes:	after 30 minutes:
Glass Cup	8.3°C	11.4°C
Stainless Steel Cup 	10.4°C	9.5°C

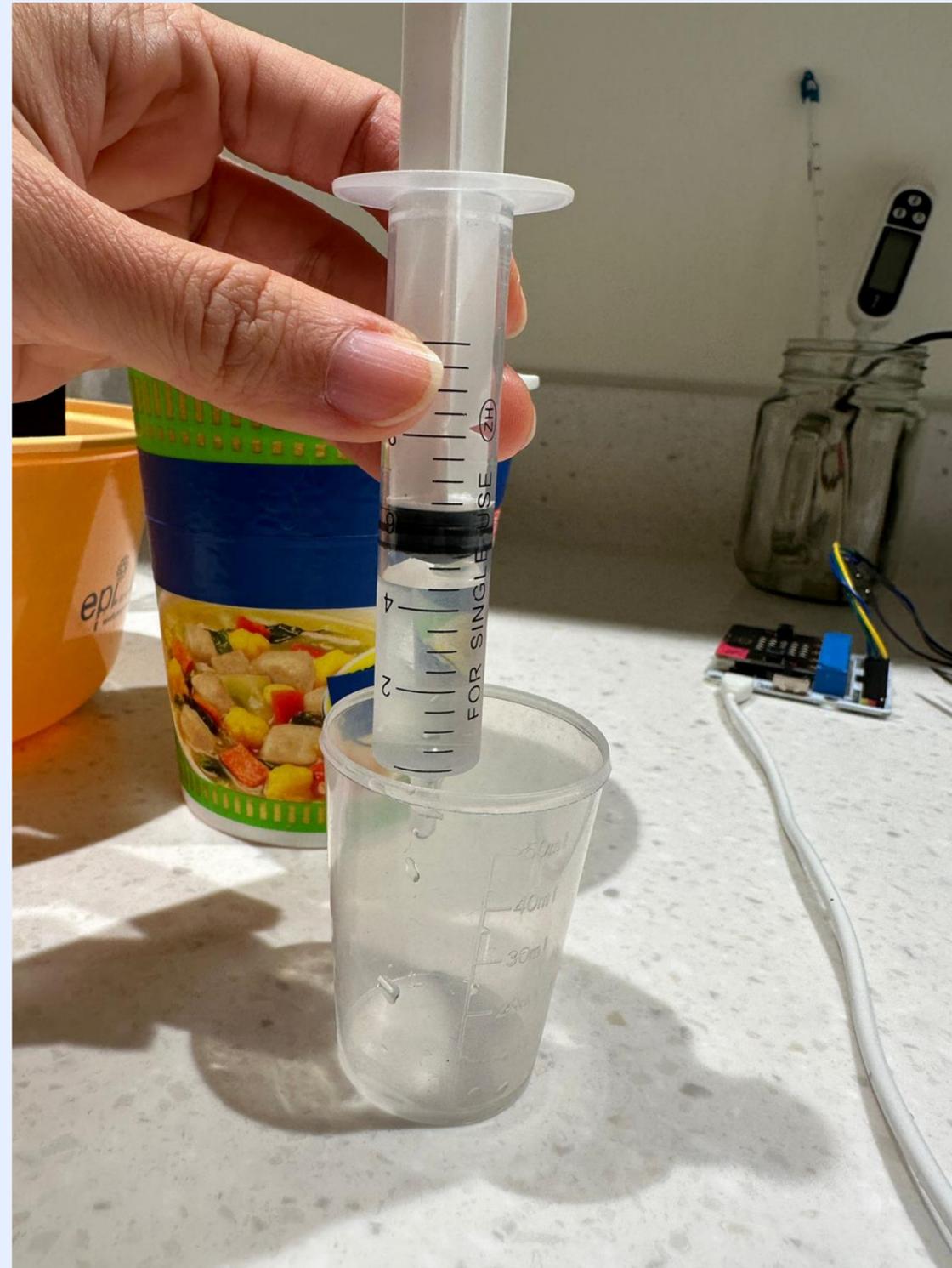
Result from different sensor



Stainless Steel Cup	after 30 minutes:
Cooking Thermometer	9.5°C 
Alcohol Thermometer	6.5°C 
DS18B20 Temperature Sensor	6°C

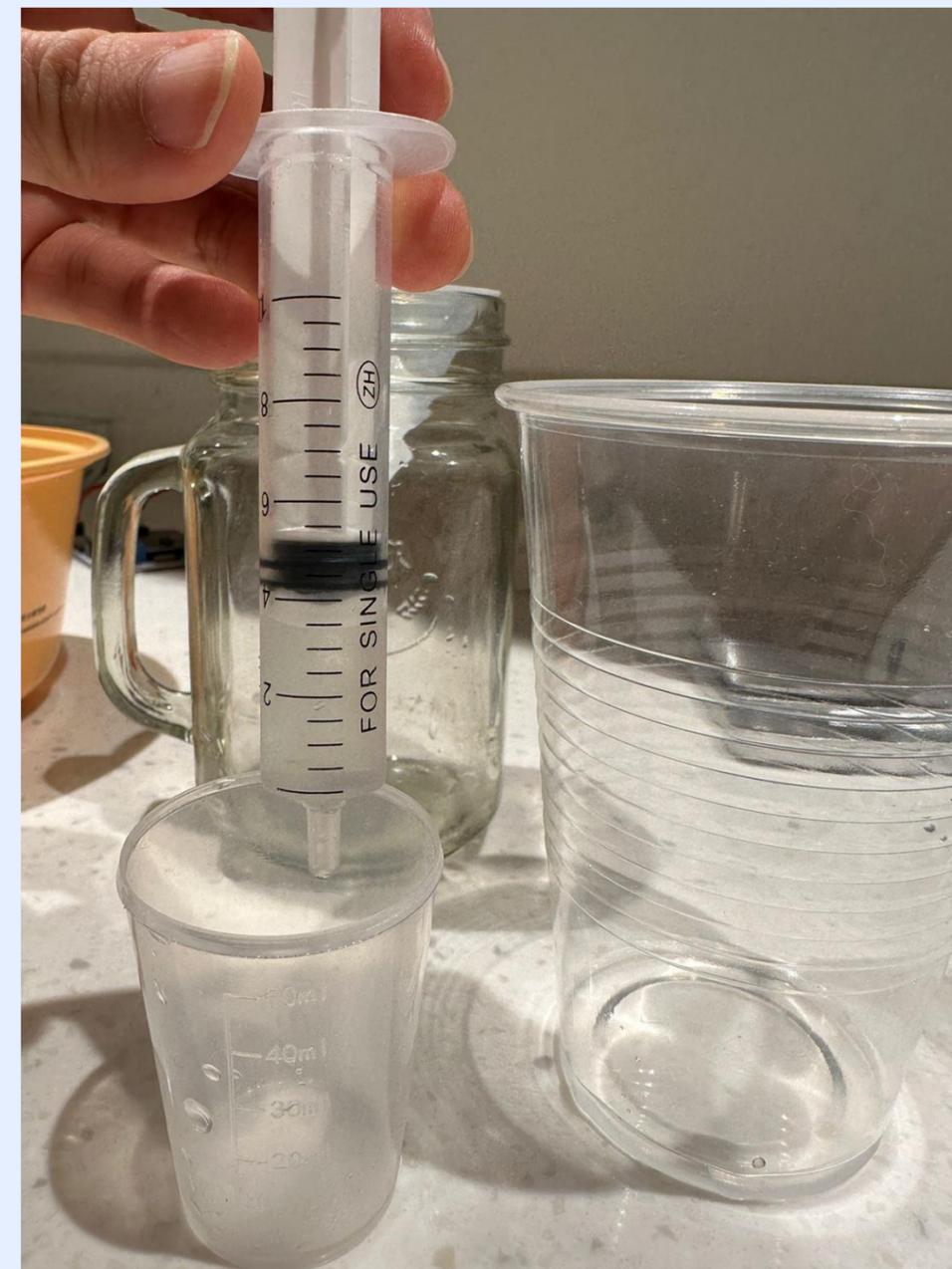
Glass Cup	after 30 minutes:
Cooking Thermometer	11.4°C
Alcohol Thermometer	7°C
DS18B20 Temperature Sensor	4.5°C 

after 30 mins:



melt water: 4.5 ml

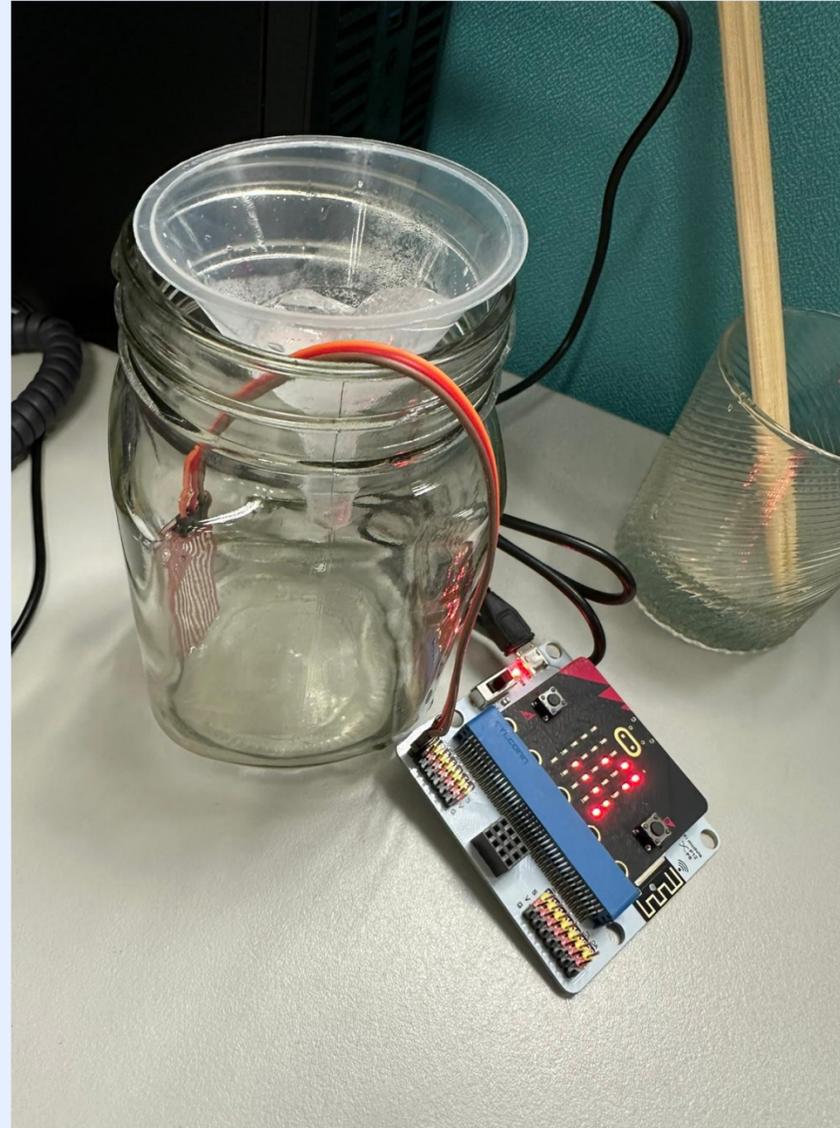
after 30 mins:



melt water: 14.5 ml

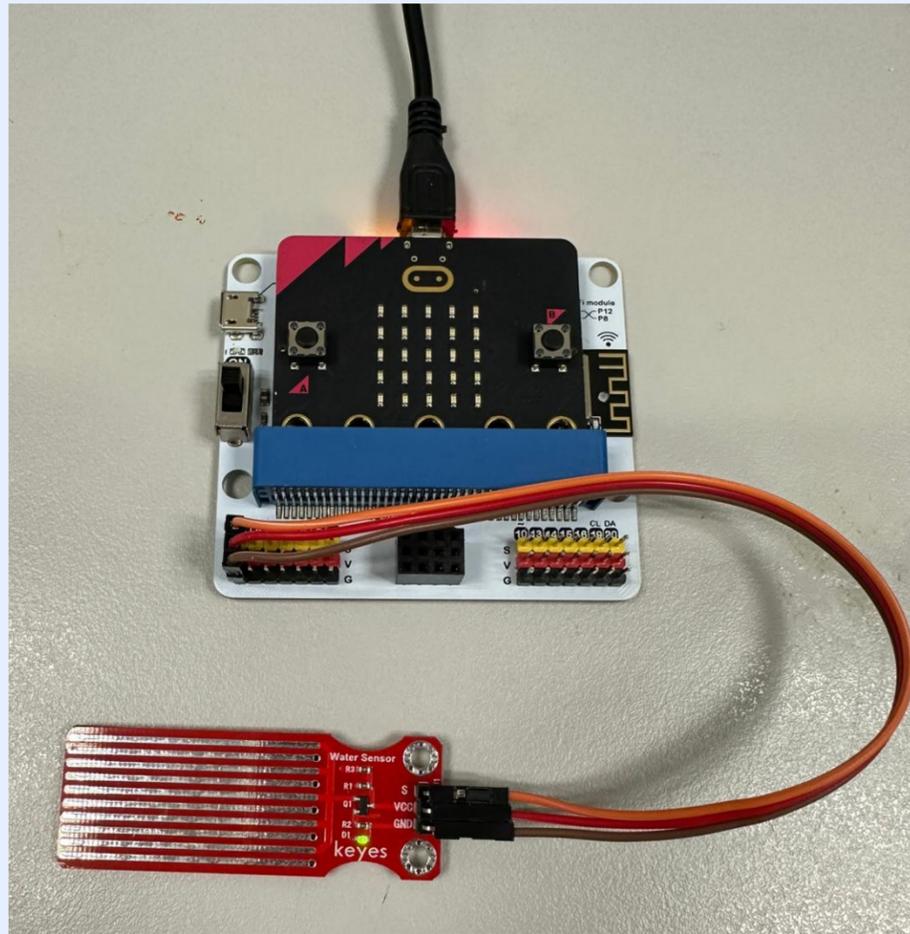
Experiment 2-Water Level Test

- with water sensor



Put the ice in the room about 10 minutes and measure the water level of melted ice.

Experiment material



Micro:bit, IoT board and water sensor



Ice, funnel and cup

Coding

-Water Level Sensor with IoT

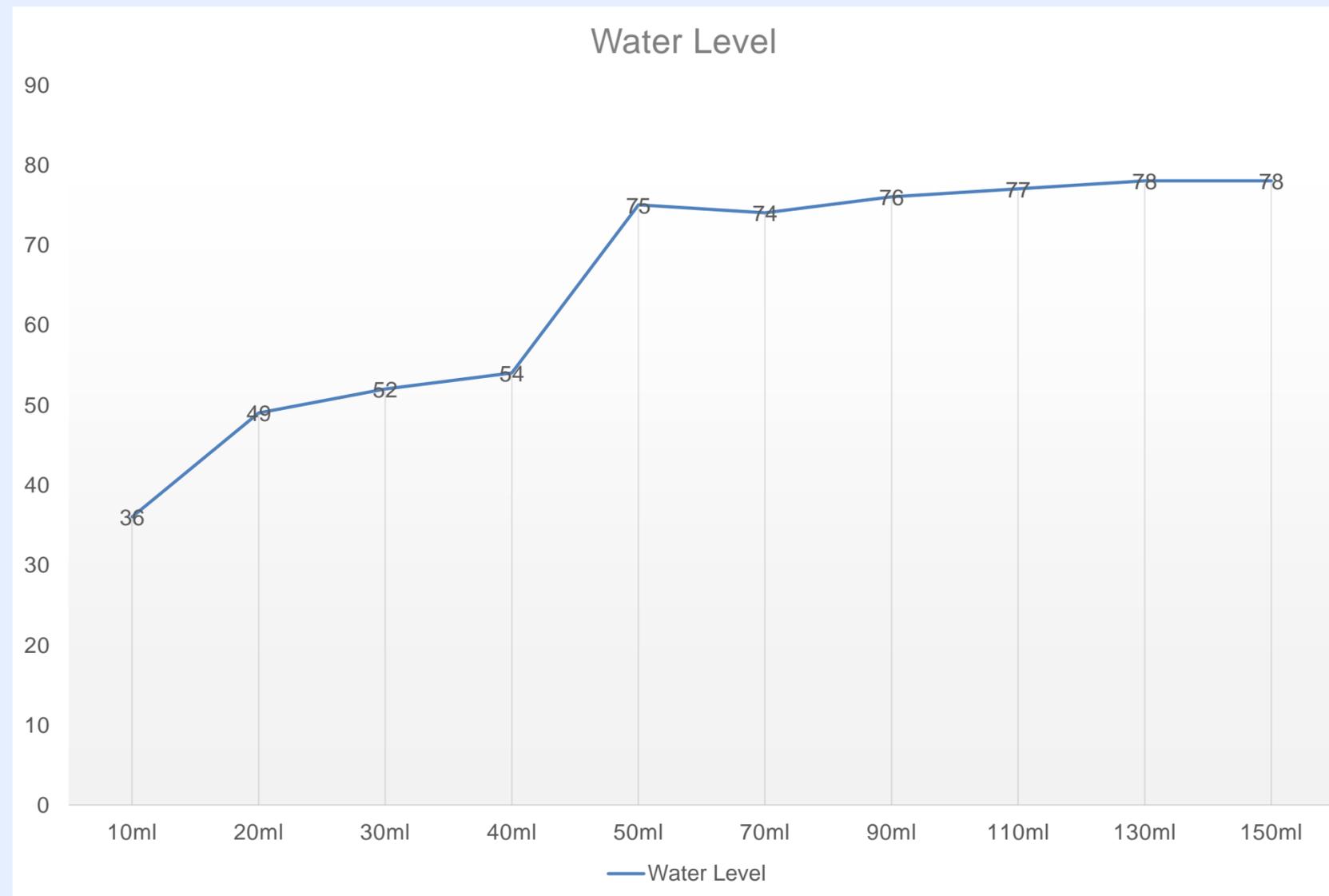
```
on start
  set ESP8266 RX P8 TX P12 Baud rate 115200
  connect Wifi SSID = "IoT" KEY = "eduhk+IoT+2018"
  if Wifi connected true then
    show icon [Water Level Sensor Icon]
  +
  forever
    connect thingspeak
    set data to send ThingSpeak
    Write API key = "N3PTP2IAB7XA6GN3"
    Field 1 = value of water level(0~100) at pin P1
    +
    Upload data to ThingSpeak
    show number value of water level(0~100) at pin P1
```

Limitation

1. The measuring range of the sensor is not wide enough for this experiment because each sample of ice is too small.
 2. The data would be distracted, such as some water drop on the top of the sensor.
 3. The angle of the sensor need to be 90° .
1. The cup body needs to be the same width.

Test for the Water Sensor

Water Level	Reading
10ml	36
20ml	49 (+13)
30ml	52 (+3)
40ml	54 (+2)
50ml	75 (+21)
70ml	74 (-1)
90ml	76 (+2)
110ml	77 (+1)
130ml	78 (+1)
150ml (full)	78 (+0)



Radio

```
on start
  radio set group 5
  set ESP8266 RX P8 TX P12 Baud rate 115200
  connect Wifi SSID = "IoT" KEY = "eduhk+IoT+2018"
  if Wifi connected true then
    show icon [wifi icon]
```

```
forever
  connect thingspeak
  set data to send ThingSpeak
  Write API key = "V6H7K6STYNPXVIUS"
  Field 1 = value of water level(0~100) at pin P1
  Upload data to ThingSpeak
  radio send number value of water level(0~100) at pin P1
```

```
on start
  radio set group 5

on radio received receivedNumber
  show number receivedNumber
```

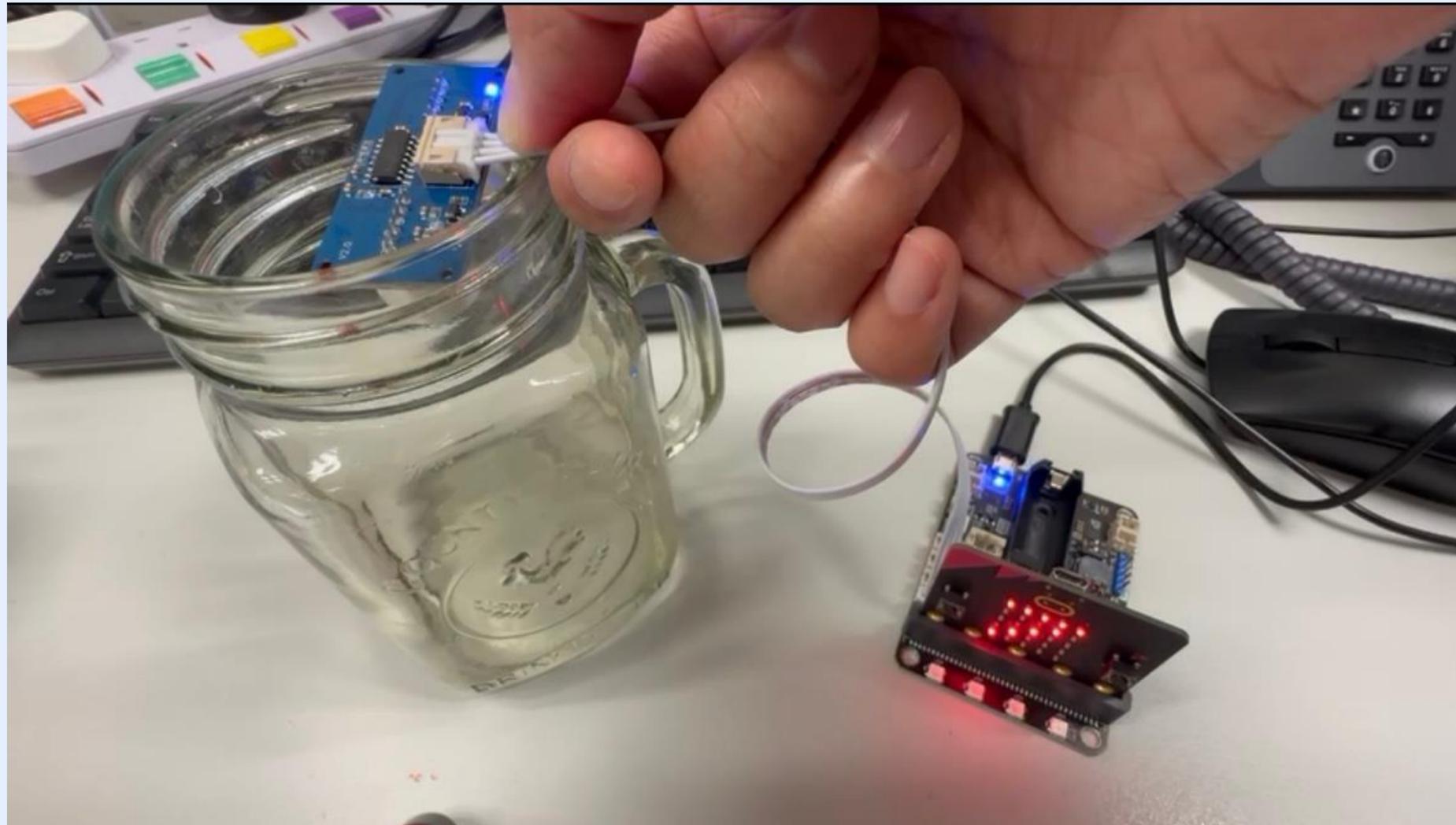


Radio

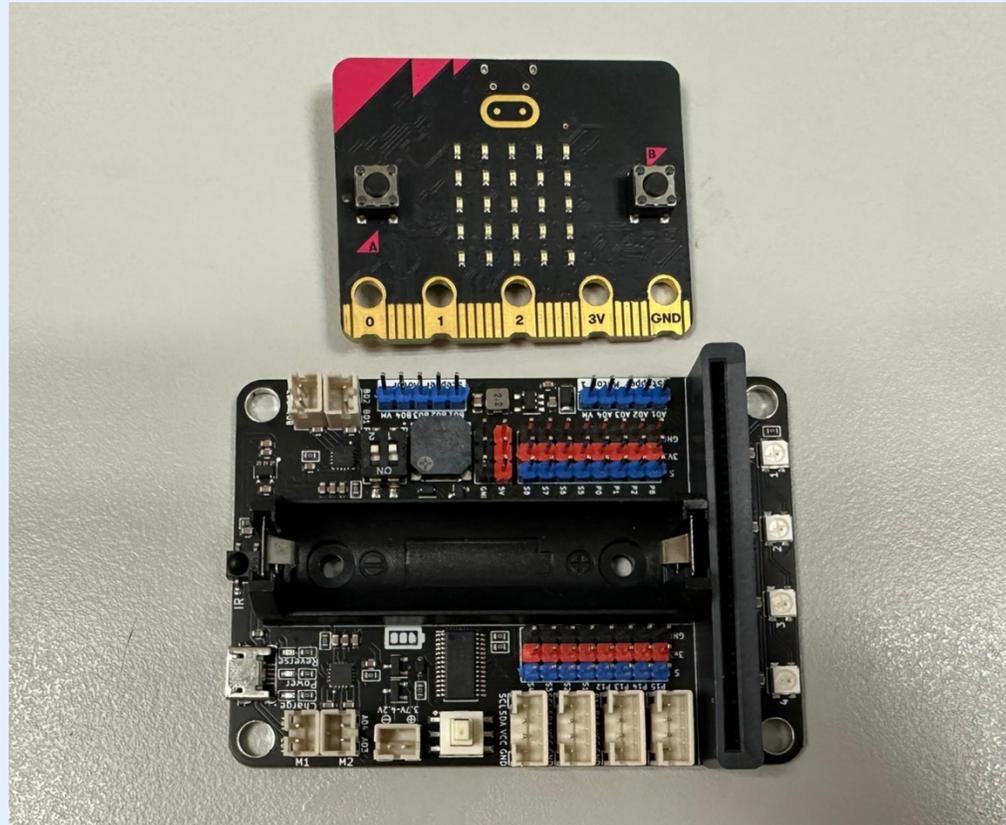


Experiment 3-Water Level Test

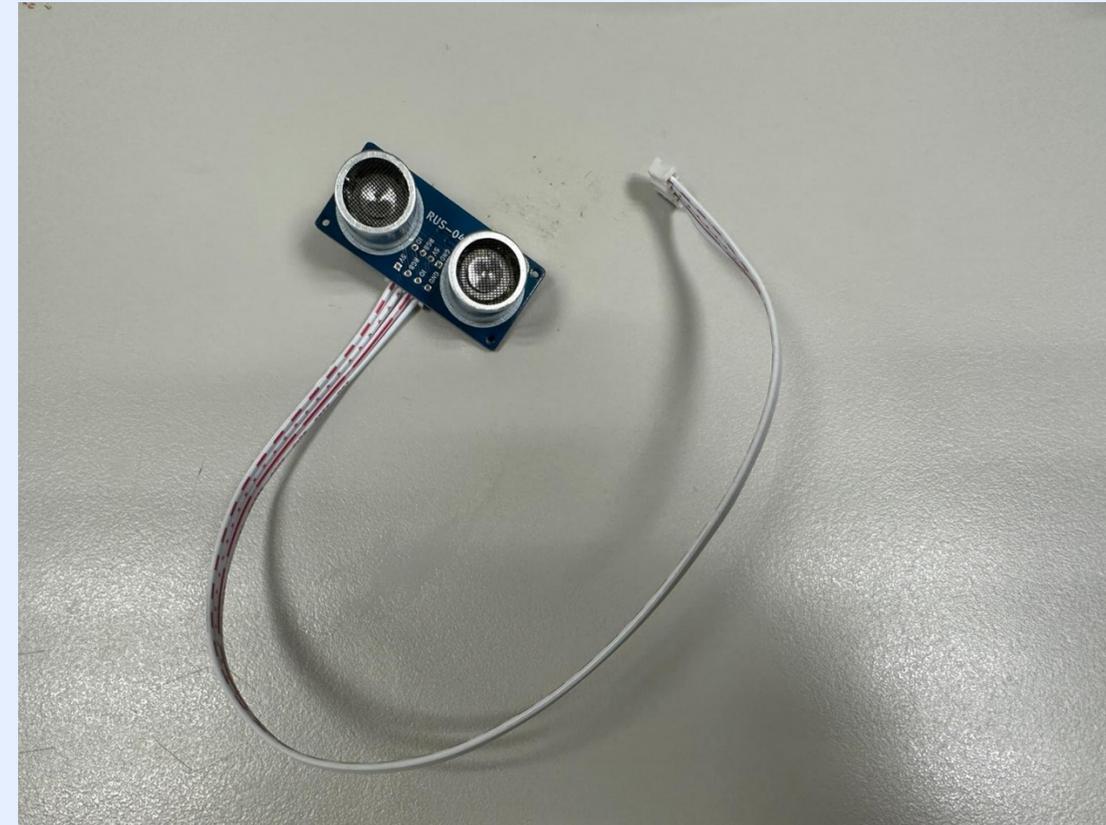
- with ultrasonic sensor



Experiment material



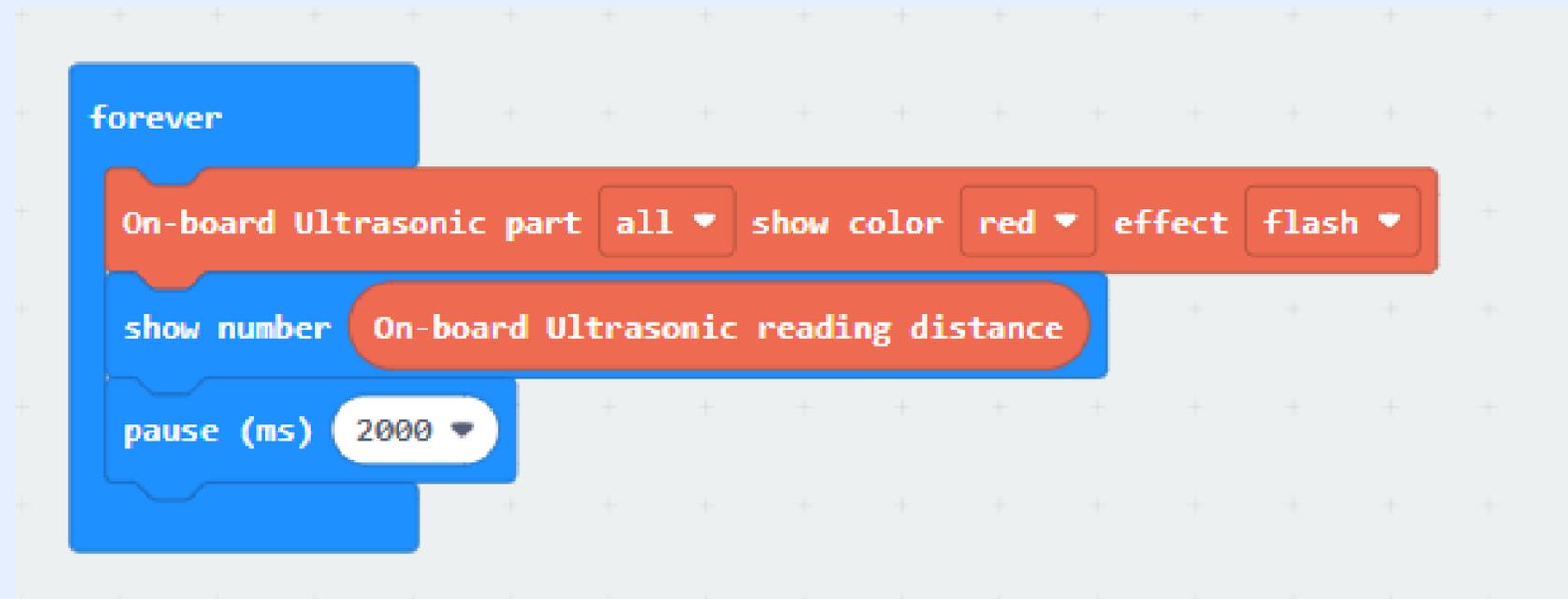
Micro:bit and motor:bit



Ultrasonic Sensor

Coding

-Ultrasonic Sensor

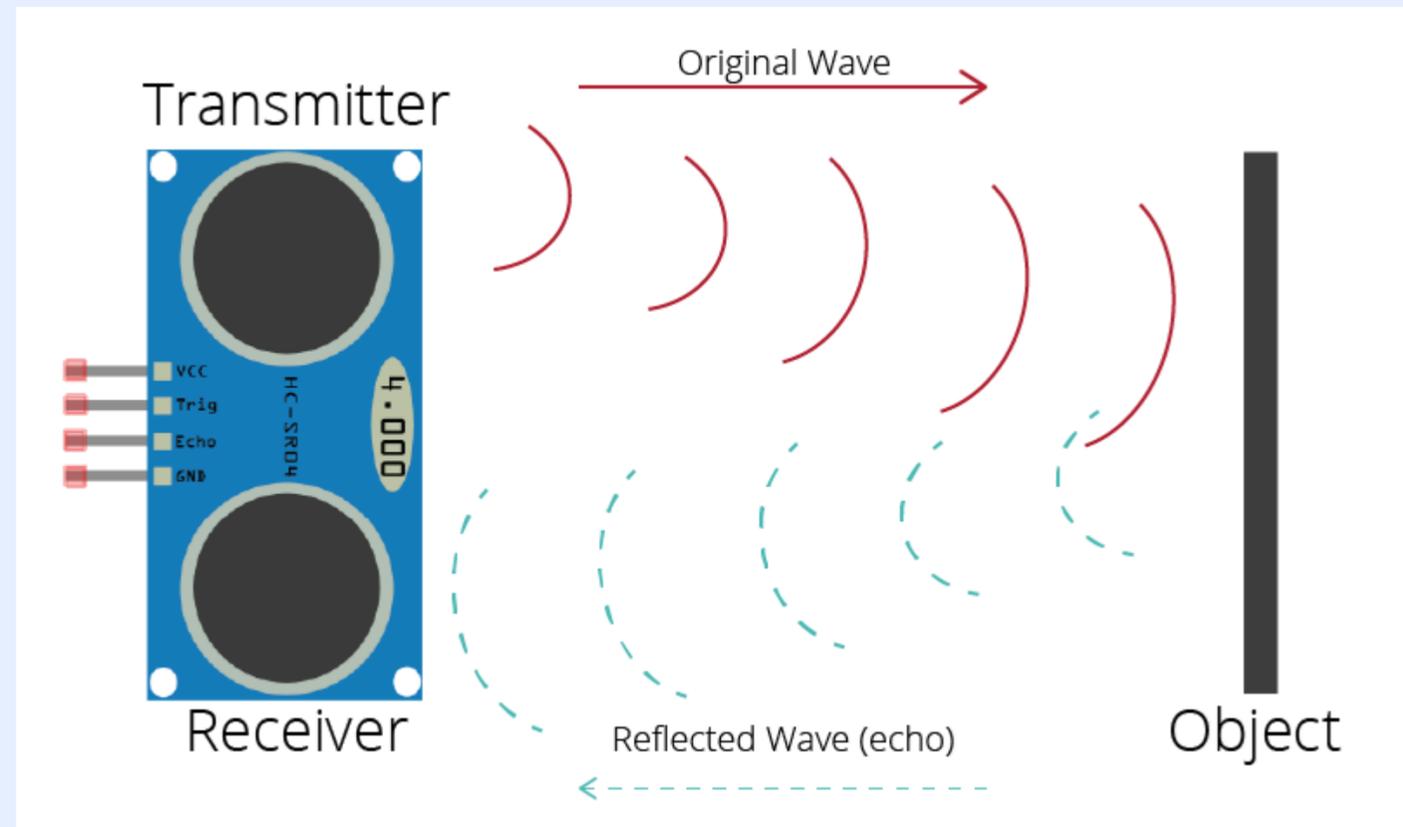


```
forever
  On-board Ultrasonic part all show color red effect flash
  show number On-board Ultrasonic reading distance
  pause (ms) 2000
```

The image shows a Scratch code editor with a yellow grid background. A blue 'forever' loop block contains three blocks: an orange 'On-board Ultrasonic part' block with dropdowns for 'all', 'show color', 'red', and 'effect flash'; a blue 'show number' block with the text 'On-board Ultrasonic reading distance'; and a blue 'pause (ms)' block with the value '2000'.

Limitation

- The sensor may be affected by other objects, it is not only reflecting the distance between the sensor and water level, so the data is not accurate.



Reference: Random Nerd Tutorials

Test for the Ultrasonic Sensor

Water Level	Reading
10ml	16
20ml	17
30ml	17
40ml	15
50ml	17

