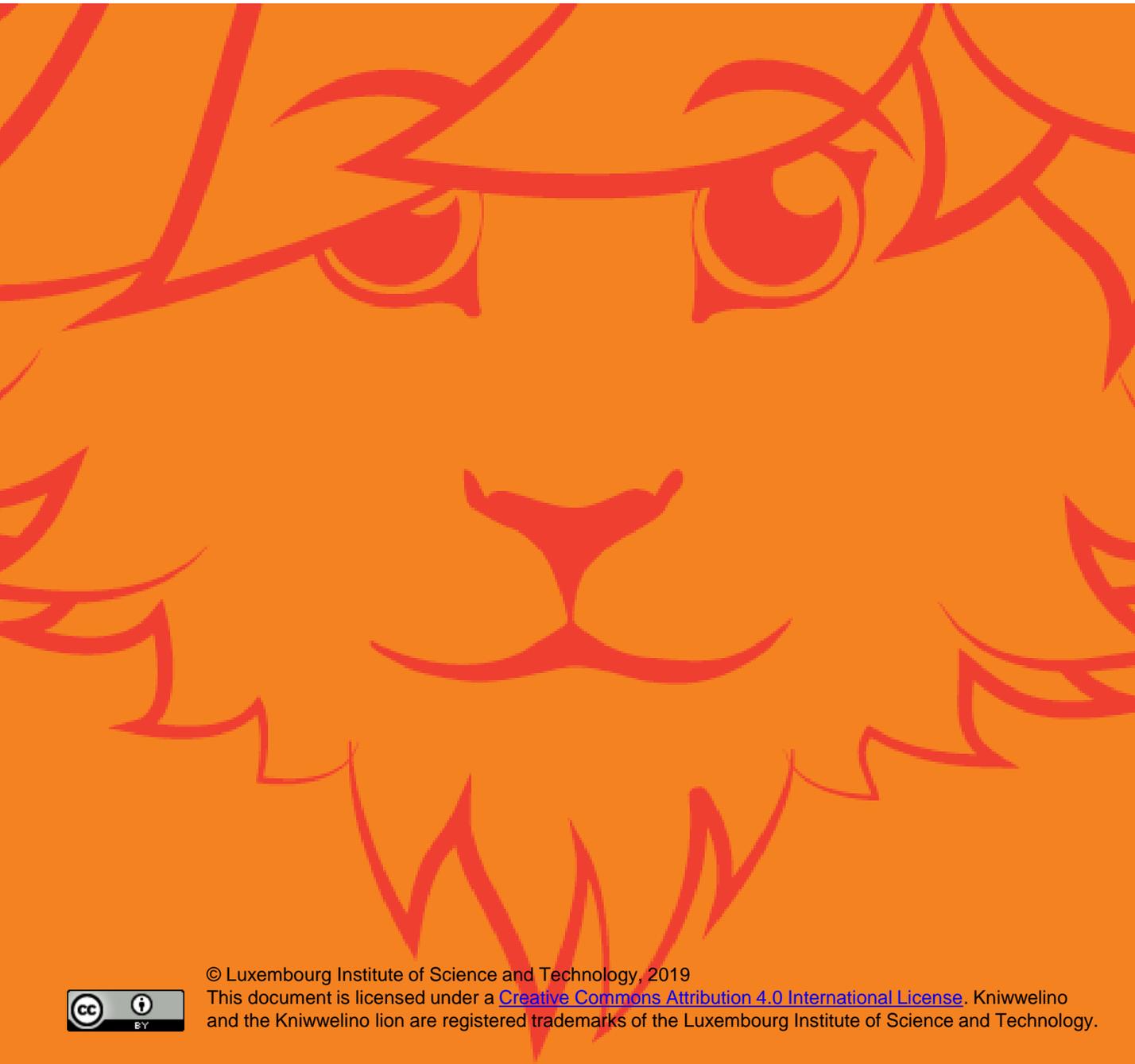




ACTIVITIES



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Activities

Activity sheet

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Buzzer

External button

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Neopixel LED strip

Temperature sensor DS18B20

Distance sensor HC-SR04

DC motor

Potentiometer

Light sensors

Sound sensor

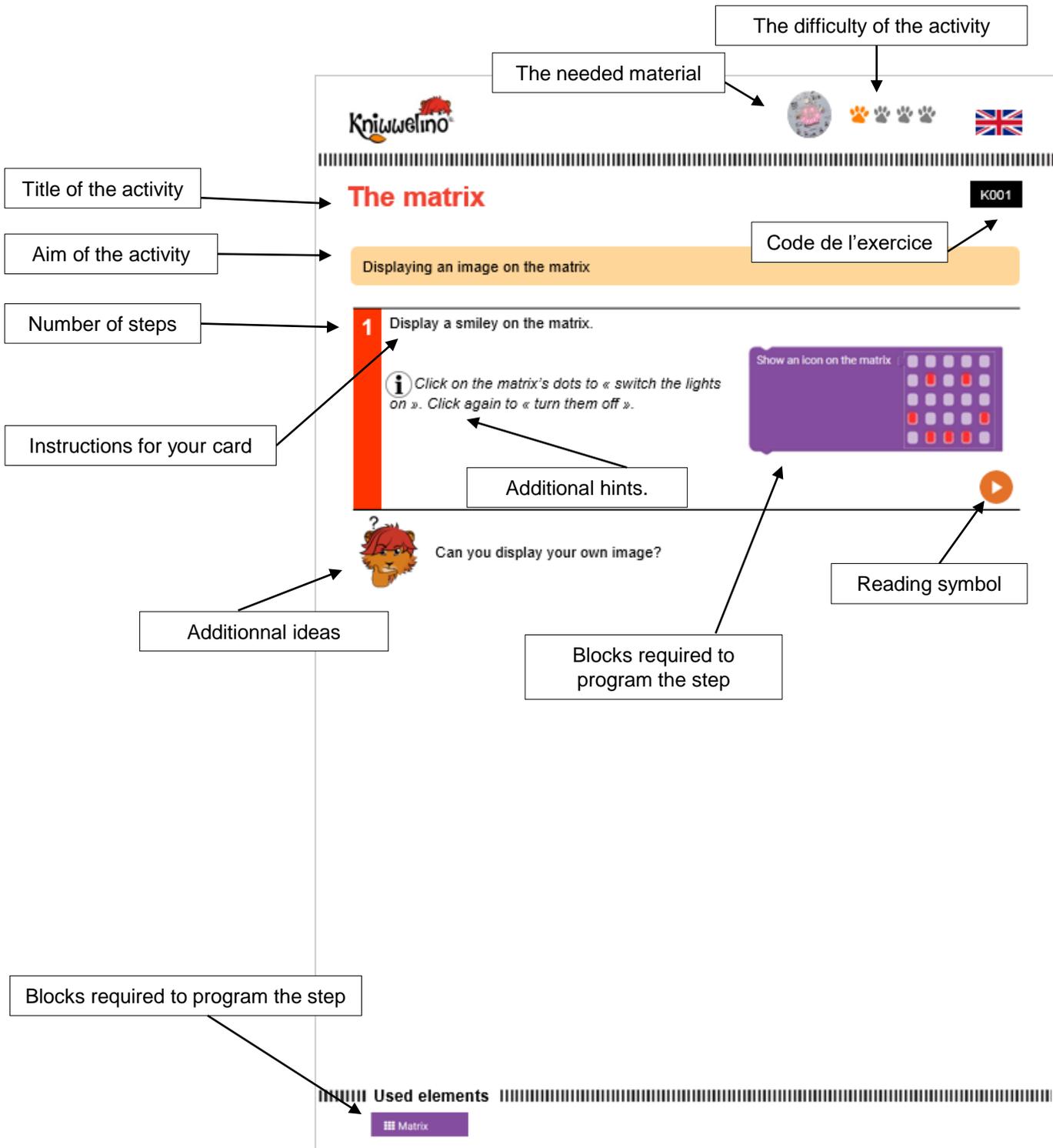
Coloured temperature display

Distance sensor and Neopixel LED Strip

Solutions

Activity sheet

Presentation



Activity sheet

How to use the activity sheets?

1. Read the **title** and the **aim**. It tells you what this activity is about.

2. Read the instruction of the **first step**.

3. Search and retrieve the required **block(s)** from the menu.



4. **Now it's your turn!** You need to connect the block(s) with the blocks already available in your program. There are several ways how they can be connected, but not all of them are correct. **It's up to you to figure out the correct way of assembling the blocks!**



5. In case you see the orange play button: use it to **transfer your program and test it**.

Make sure your program is doing what it is supposed to do. If not, then revise your program.

6. Continue with the next steps: read the instruction and add the next block(s) to your program. Again, test the result if possible.

7. When done with all the steps, you are free to change your program and **try out Lino's suggestions** or even your own ideas!

8. Don't forget to delete the different blocks used before a new activity.

PROGRESS

Activity	Date	Comment
The Matrix		
The coloured LED		
Alternating colours		
Animation		
Buttons and matrix		
Messages		
Variable		
Variables and logic		
Time and mathematics		
Matrix and loops		
External LED		
Buzzer		
External button		
Servo motor SG90		
Neopixel LED strip		
Temperature sensor DS18B20		
Distance sensor HC-SR04		
DC motor		
Potentiometer		
Coloured temperature display		
Distance sensor and Neopixel LED Strip		

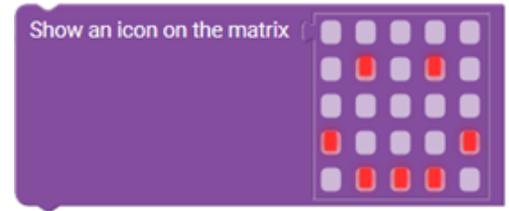
The matrix

K001

Displaying an image on the matrix

1 Display a smiley on the matrix.

i Click on the matrix's dots to « switch the lights on ». Click again to « turn them off ».



Can you display your own image?

The coloured LED

K002

Switching on the LED in a colour, making it blink and changing the brightness

1 Switch on the LED in green.

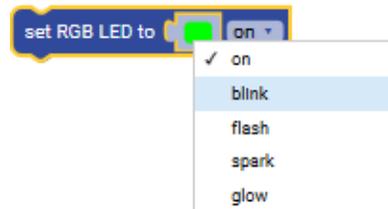


2 Change the color.



i To choose another colour, click on the green field: the palette of available colours is displayed.

3 Make the LED blink by changing the effect.



4 Decrease the brightness of the LED.



What happens if you choose flash, spark or glow as an effect?

Alternating colours

K003

Lighting the LED successively in different colours.

1 Switch on the LED in green.



2 Wait 3 seconds.

 Click on the number to change it.



3 Switch on the LED in red and wait 3 seconds.



Can you activate the LED successively in 3 different colors?

How can you speed up the colour change?

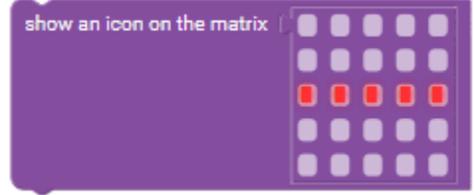


Animation

K004

Creating an animation consisting of multiple images displayed at 1 second intervals.

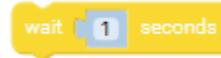
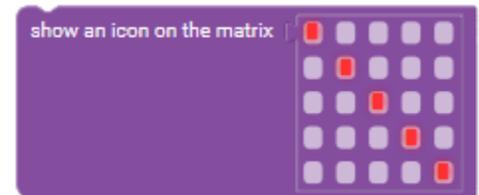
1 Display an horizontal bar on the matrix.



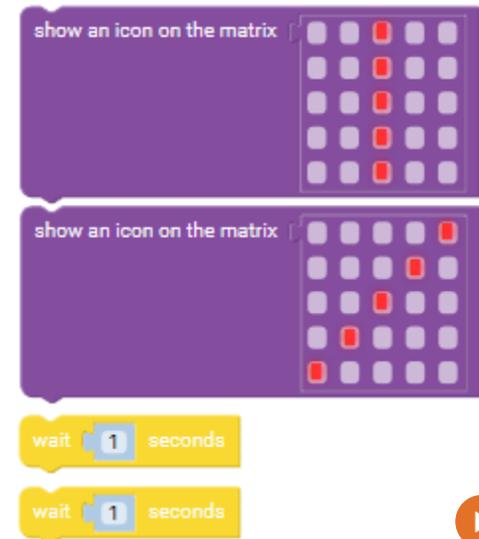
2 Wait 1 second.



3 Display a slash bar on the matrix during 1 second.



4 Continue until you created the complete animation.



Can you create your own animation?

Buttons and matrix

K005

Displaying images on the matrix at the click of a button. A different image appears for each button (A or B), as well as for A and B.

1 When button A is pressed, then display a smile on the matrix.

2 When button B is pressed, then display a sad face.

3 When buttons A and B are both pressed, the display your own image.



Can you also activate the LED in different colours at the click of the buttons?

Messages

K006

Sending texts, images and colours to another Kniwwelino to change the matrix display or the LED colour.

i Do this activity with a friend so you can send each other messages.

1	<p>Connect the LED and the matrix to predefined topics.</p>	<p>Connect RGB Led to topic RGB/COLOR</p> <p>Connect matrix to topic MATRIX/TEXT and MATRIX/I...</p>
2	<p>Set the group name to something secret.</p> <p>i All Kniwwelinos who are in the same group as you will receive the messages.</p>	<p>create messaging group “ myFriends ”</p>
3	<p>Send a colour and an icon to the predefined topics when button A is clicked.</p>	
4	<p>Send another colour and a text to the predefined topics when button B is clicked.</p>	

Variable

K007

Storing a value with a variable and using it again: each time that button A is pressed, the value of the variable is increased and displayed it on the matrix.

- 1 Set the initial value of the variable to 0 in Kniwwelino on start.

- 2 When button A is clicked, increase the value of the variable by 1.

- 3 Display the value of the variable on the matrix.



What will be the first value displayed?

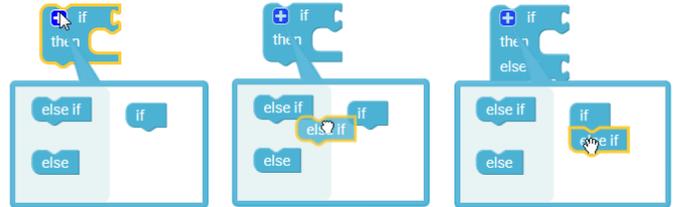
How can you decrease the value of the variable by 1 each time when button B is clicked?

Variables and logic

K008

Selecting and displaying on the matrix an icon from a list of three.

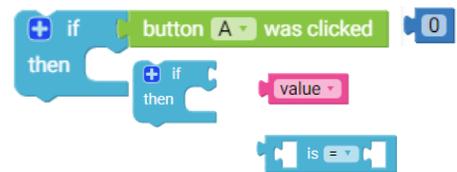
i To add a condition « else if » to a block « if ...then » click on « + » then drag&drop under « if ».



1 Set the initial value of the variable to 0 in **Kniwwelino on start**.



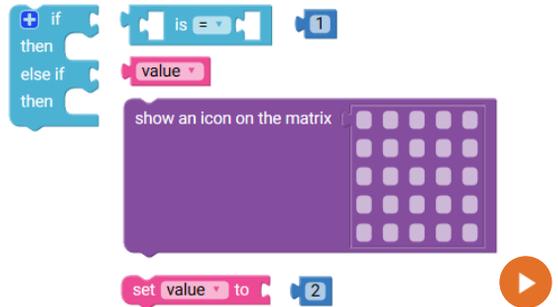
2 In **Kniwwelino repeat forever**, if button A is clicked, check if the variable is equal to 0.



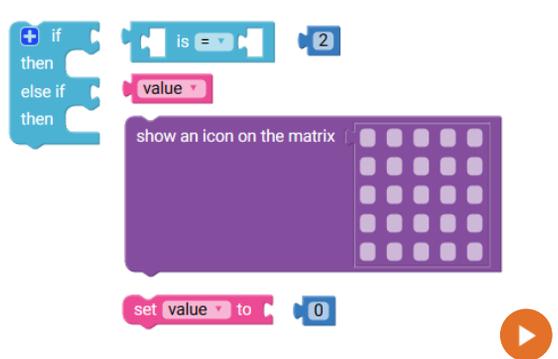
3 If yes, then display a sad face on the matrix and set the variable to 1.



4 Else, check if the variable is equal to 1. In this case display a smiley.
Then set the variable to 2.



5 Else, check if the variable to 2. In this case display your own image example giving a heart.
Then set the variable to 0.



Time and Mathematics

K009

Using time and mathematics to create a simple chronometer. Start the chronometer with button A and stop it with the button B. Display the time on the matrix.

1 When button A is clicked, measure the time and set it in a variable called **start**.

```

if button A was clicked
then
  current elapsed time (seconds)
  set start to
  
```

2 When button B is clicked, then measure again the time and deduct from it the value stored in **start**. Write the result on the matrix.

```

if button B was clicked
then
  start
  current elapsed time (seconds)
  write a text on the matrix " Hello Kniwwelino " repeating
  
```

3 Every time I click button A, also erase the matrix.

```

clear matrix
  
```

4 When the chronometer is running, switch the LED on in red. If it has been stopped, switch off the LED.

```

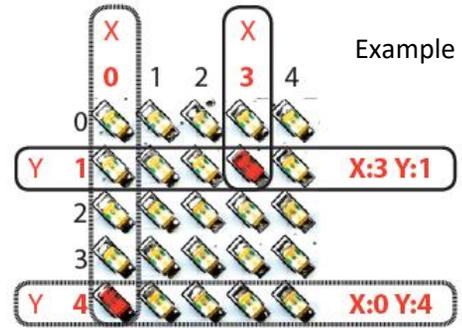
set RGB LED to on
switch RGB LED off
  
```

Matrix and Loops

K010

Using loops to repeat something similar: light pixel after pixel on the matrix.

i If you want to draw a single pixel on the matrix, you have to tell Kniwwelino which column (X) and which row (Y) it is in.



1 Create a loop that counts i from 0 to 4, increasing each time by 1.

```

count with i from 0 to 4 by 1
do
  
```

2 Every time you enter the loop, turn on the pixel on column $X = i$ and the row $Y = 0$.

```

draw a pixel on the matrix X i Y 0 LED state 1
  
```

3 Before the end of the loop, wait 1 second.....

```

wait 1 seconds
  
```

4 and erase the matrix.

```

clear matrix
  
```



What do you have to change to turn on the pixels in the middle row?

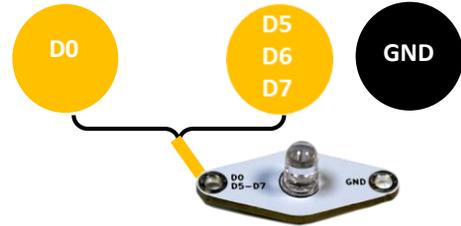
What happens if you delete the matrix only after the loop?

External LED

K011

Switching on an external LED, and making it blink.

1 Connect the external LED via **D0** and **GND**



2 Switch on the external LED.

set external LED on pin D0 to on



3 Make the external LED blink.

set external LED on pin D0 to blink

- on
- ✓ blink
- flash
- off



Can you add a second LED of another color?

Can you switch on the first LED when button A is clicked, and switch on the second LED when button B is clicked.



Buzzer

K012

Connecting a buzzer and playing musical notes.

1 Connect the buzzer via **D5** and **GND**



2 Play the first note: G 4

```
Play Note [G 4] of duration 1/ [4] on Pin [D5]
```



3 Play the second note: C 5

```
Play Note [C 5] of duration 1/ [4] on Pin [D5]
```



4 Continue with the third note: C 3

```
Play Note [C 3] of duration 1/ [4] on Pin [D5]
```



5 Make a pause at the end.

```
Play Note [Pause] of duration 1/ [4] on Pin [D5]
```



Change the notes and create your own melody!



External button

K013

Connecting an external button and using it in the same way as the A&B buttons of the board.

1 Connect the external button via **D5** and **GND**.

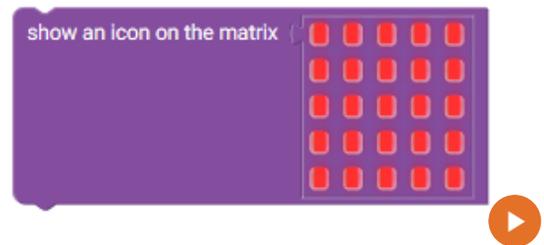


2 Check if the external button connected to D5 is pressed.

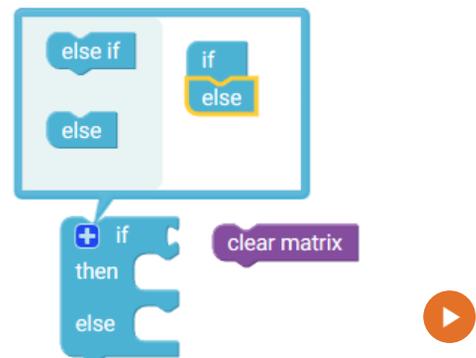
*Be careful to use **is pressed** and not **is clicked**!*



3 If so, turn on all the LEDs in the matrix.



4 Otherwise, turn off the matrix.

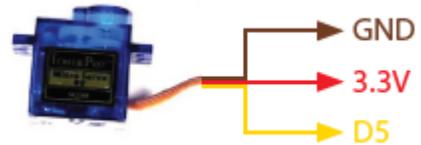


Servo motor SG90

K014

Connecting a servo motor and rotating it when the buttons are clicked.

1 Connect the servo motor via **3.3V**, **GND** and **D5**.



2 If buttons A and B are clicked at the same time then move the motor on the position of 0°.

```

+ if button A and B was clicked
then
  set servo angle on pin D5 to 0 degrees
  
```



3 If button A is clicked then move the motor to the 90° position.

```

+ if button A was clicked
then
  set servo angle on pin D5 to 90 degrees
  
```



4 If button B is clicked then move the motor to the 180° position.

```

+ if button B was clicked
then
  set servo angle on pin D5 to 180 degrees
  
```



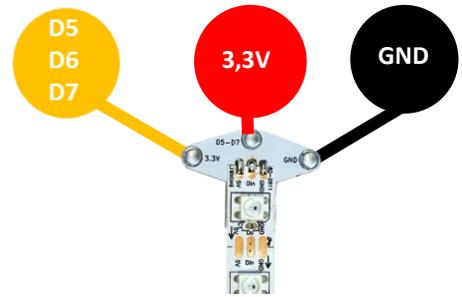


Neopixel LED Strip

K015

Creating an effect on a strip of 5 LEDs.

1 Connect the Neopixel LED Strip via **3.3V**, **D5** and **GND**.



2 Initialize a strip of 5 Neopixel LEDs on the pin D5.

Neopixel LED Strip with size 5 on pin D5

3 Set an effect.

set strip to effect: RUNNING_LIGHTS [18]



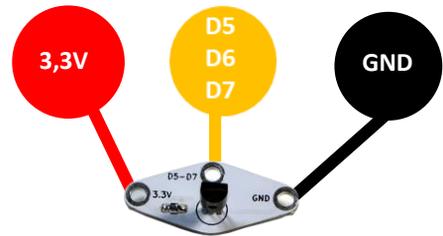
Try other effects! What is your favourite one?

Temperature Sensor DS18B20

K016

Connecting a temperature sensor, reading the temperature and writing it on the matrix.

1 Connect the temperature sensor via **3.3V**, **D5** and **GND**.



2 Read the temperature and store it into a variable.

```

set [value] to
DS18B20 read temperature [°C] on Pin D5
    
```

3 Write the temperature on the matrix, and wait until you are finished writing.

```

[value]
write a text on the matrix " Hello " once and wait
    
```

- repeating
- once
- ✓ once and wait



What is the temperature of the room?

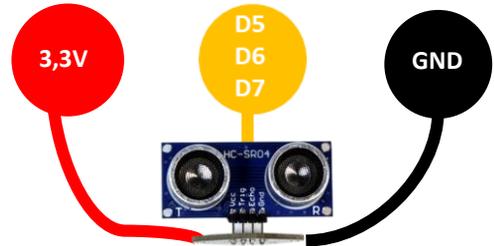
What is the temperature of your finger?

Distance Sensor HC-SR04

K017

Connecting a distance sensor and displaying different colours depending on the distance.

1 Connect the distance sensor via **3.3V**, **D5** and **GND**.



2 Detect if a hand is closer than 50 cm.

```

if then
  is < 50
  HC-SR04 read distance [cm] on Pin D5
  
```

3 If yes, then colour the LED in red.

```

set RGB LED to on
  
```

4 If not, then colour the LED in green.

```

else if
  if else
  else
  + if then else
    set RGB LED to on
  
```



Show three different colours: red when your hand is very close (less than 20cm), yellow when it is less than 50cm, and green when more than 50cm.

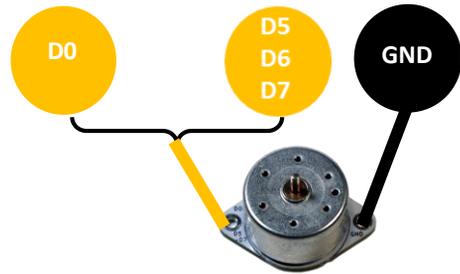


DC Motor

K018

Connecting a DC Motor; starting and stopping it on button click.

1 Connect the DC Motor via **D5** and **GND**.



2 When button A is clicked, then start the motor.

```

+ if button A was clicked
  then
    set pin D5 to digital value HIGH
  
```



3 When button B is clicked, then stop the motor.

```

+ if button B was clicked
  then
    set pin D5 to digital value LOW
  
```



4 When buttons A and B are both clicked, the make the motor turn slowly.

```

+ if button A and B was clicked
  then
    set pin D5 to analog value 50
  
```



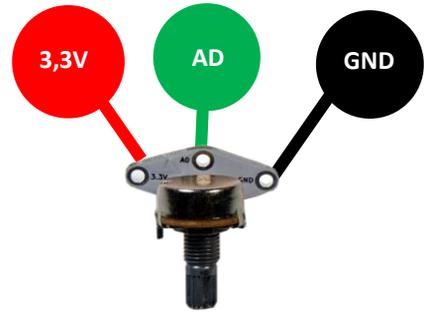


Potentiometer

K019

Connecting a potentiometer and setting the colour of the RGB LED based on its value.

1 Connect the potentiometer via **3.3V**, **A0** and **GND**.



1 Read the analog value of the potentiometer and store it in a variable **value**.

```
set value to
read analog pin A0
```



2 Create a hue from the value and set the RGB LED to this hue.

```
hue 0
set RGB LED to value on
```



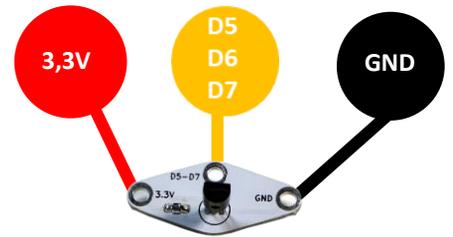
Instead of changing the hue, change the brightness of the RGB LED using the value of the potentiometer.

Coloured temperature display

K020

Connecting a temperature sensor, reading the temperature and colouring the RGB LED accordingly.

1 Connect the temperature sensor via **3.3V**, **D5** and **GND**.



2 Read the temperature and store it into a variable temp.

```

set temp to
DS18B20 read temperature [°C] on Pin D5
    
```

3 Write the temperature on the matrix.

```

temp
write a text on the matrix " Hello Kniwwelino " repeating
    
```

4 Change temp: instead of having a value between 25-32 map it to 255-0

```

set temp to temp
map value from [ 25 - 32 ] to [ 255 - 0 ]
    
```

5 Use temp as hue value and colour the LED with this hue.

```

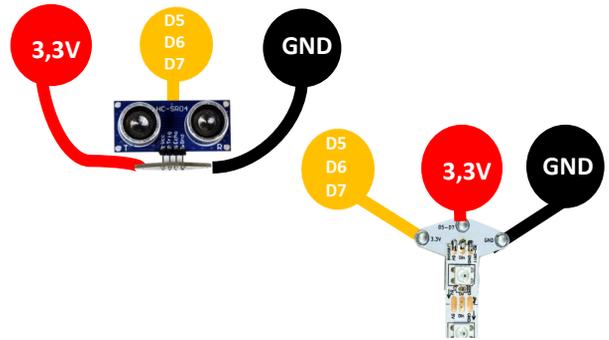
set RGB LED to on hue 0
wait 0.5 seconds temp
    
```

Distance sensor and Neopixel LED strip

K021

Connecting an input and an output extension. Showing the distance visually on the LED strip: every 10 cm another LED lights up.

- 1** Connect:
- a distance sensor via **3.3V**, **D5** and **GND**
 - a neopixel LED Strip via **3.3V**, **D6** and **GND**



- 2** Initialize a strip of 5 Neopixel LEDs on the pin D6.

```
Neopixel LED Strip with size 5 on pin D6
```

- 3** Read the distance and store it in a variable **value**.

```
set value to
HC-SR04 read distance [cm] on Pin D5
```

- 4** Check if the distance is less or equal to 50 cm.

```
if value is <= 50 then
```

- 5** If yes, calculate the position of the pixel to be switched on, by dividing the distance by 10.

```
set pixel to (value / 10)
```

- 6** Write the pixel on the matrix.

```
write a text on the matrix "Hello" repeating
pixel
```

- 7** Activate this pixel on the strip.

```
set pixel 0 to color: green pixel
```

- 8** Wait 300 ms and then switch it off again.

```
wait 300 milliseconds
stop strip effect
```

Used elements



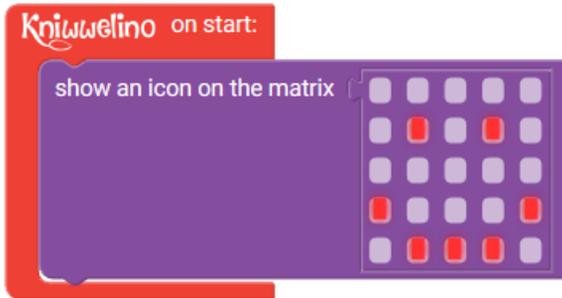
SOLUTIONS



Matrix

K001

```
Kniwwelino on start:  
show an icon on the matrix
```



The coloured LED

K002

```
Kniwwelino repeat forever:  
set RGB LED to green blink  
set RGB LED brightness to 100
```



Change of Colour

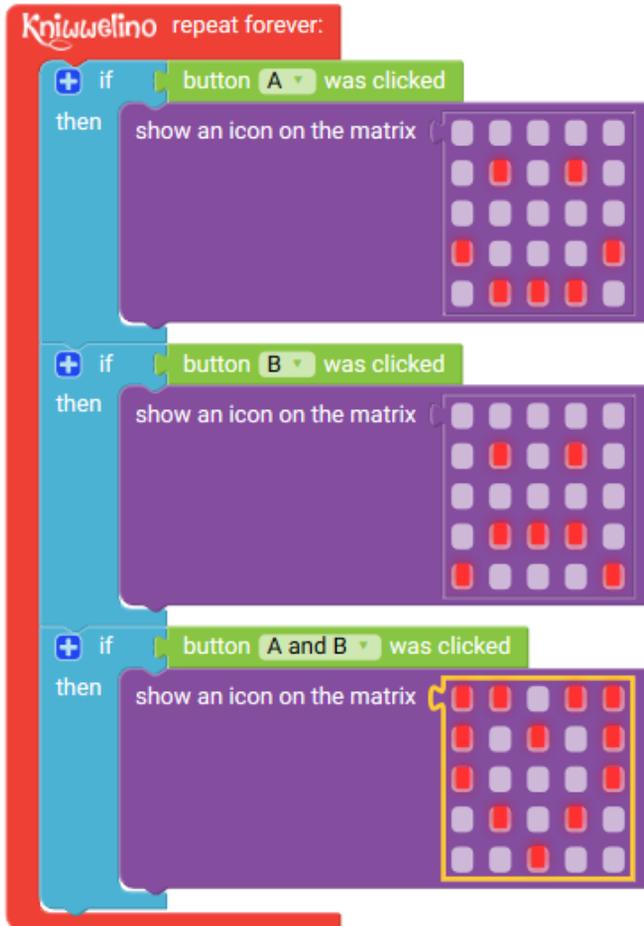
K003

```
Kniwwelino repeat forever:  
set RGB LED to green on  
wait 5 seconds  
set RGB LED to red on  
wait 5 seconds
```



Button and matrix

K005



Messages

K006

```

Kniwwelino join messaging group "myFriends"
Kniwwelino connect matrix to topic MATRIX/TEXT and MATRIX/I...
Kniwwelino connect RGB LED to topic RGB/COLOR
Kniwwelino repeat forever:
  if button A was clicked then
    send [Matrix Icon] to group topic "MATRIX/ICON"
    send [Green] to group topic "RGB/COLOR"
  if button B was clicked then
    send "Hello Friends!" to group topic "MATRIX/TEXT"
    send [Red] to group topic "RGB/COLOR"
  
```

Variables

K007

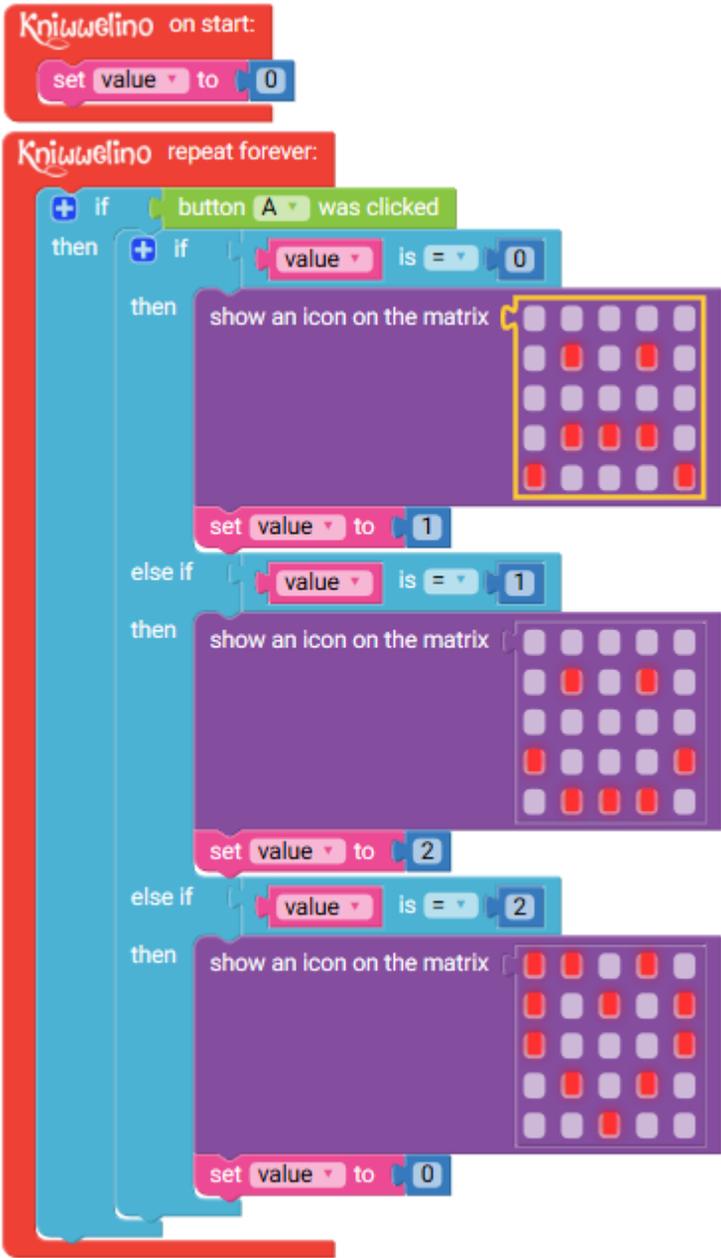
```

Kniwwelino on start:
  set value to 0
Kniwwelino repeat forever:
  if button A was clicked then
    increase value by 1
    write a text on the matrix [value] repeating
  if button B was clicked then
    set value to [value] - 1
    write a text on the matrix [value] repeating
  
```

Variable and logic

K008

```
Kniwwelino on start:  
  set value to 0  
  
Kniwwelino repeat forever:  
  if button A was clicked  
  then  
    if value is = 0  
    then  
      show an icon on the matrix  
      set value to 1  
    else if value is = 1  
    then  
      show an icon on the matrix  
      set value to 2  
    else if value is = 2  
    then  
      show an icon on the matrix  
      set value to 0
```



Time and Mathematics

K009

```
Kniwwelino repeat forever:  
+ if button A was clicked  
then  
  clear matrix  
  set start to current elapsed time (seconds)  
  set RGB LED to on  
  
+ if button B was clicked  
then  
  write a text on the matrix current elapsed time (seconds) - start repeating  
  switch RGB LED off
```

Matrix and Loops

K010

```
Kniwwelino repeat forever:  
count with i from 0 to 4 by 1  
do  
  draw a pixel on the matrix X i Y 0 LED state 1  
  wait 1 seconds  
  clear matrix
```

External LED

K011

```
Kniwwelino repeat forever:  
set external LED on pin D0 to blink
```

Buzzer

K012

```

Kniwwelino repeat forever:
  Play Note G 4 of duration 1/ 4 on Pin D5
  Play Note C 5 of duration 1/ 4 on Pin D5
  Play Note C 3 of duration 1/ 4 on Pin D5
  Play Note Pause of duration 1/ 4 on Pin D5
  
```

External Button

K013

```

Kniwwelino repeat forever:
  if external button on pin D5 is pressed
  then
    show an icon on the matrix
  else
    clear matrix
  
```

Servo motor SG90

K014

```

Kniwwelino repeat forever:
  if button A and B was clicked
  then
    set servo angle on pin D5 to 0 degrees
  else if button A was clicked
  then
    set servo angle on pin D5 to 90 degrees
  else if button B was clicked
  then
    set servo angle on pin D5 to 180 degrees
  
```

Neopixel LED Strip

K015

```
Neopixel LED Strip with size 5 on pin D5
Kniwwelino repeat forever:
  set strip to effect: RUNNING_LIGHTS [18]
```

Temperature Sensor DS18B20

K016

```
Kniwwelino repeat forever:
  set value to DS18B20 read temperature [°C] on Pin D5
  write a text on the matrix value once and wait
```

Distance sensor HC-SR04

K017

```
Kniwwelino repeat forever:
  if HC-SR04 read distance [cm] on Pin D5 is < 50
  then set RGB LED to red on
  else set RGB LED to green on
```

DC Motor

K018

```

Kniwwelino repeat forever:
  + if button A was clicked
  then set pin D5 to digital value HIGH
  + if button B was clicked
  then set pin D5 to digital value LOW
  + if button A and B was clicked
  then set pin D5 to analog value 50
  
```

Potentiometer

K019

```

Kniwwelino repeat forever:
  set value to read analog pin A0
  set RGB LED to hue value on
  
```

Coloured temperature display

K020

```

Kniwwelino repeat forever:
  set temp to DS18B20 read temperature [°C] on Pin D5
  write a text on the matrix temp repeating
  set temp to map temp value from [ 25 - 32 ] to [ 255 - 0 ]
  set RGB LED to hue temp on
  wait 0.5 seconds
  
```

Distance Sensor and RGB LED Strip

K021

```
Neopixel LED Strip with size 5 on pin D6  
Kniwwelino repeat forever:  
  set value to HC-SR04 read distance [cm] on Pin D5  
  if value is < 50  
  then  
    set pixel to value ÷ 10  
    write a text on the matrix pixel repeating  
    set pixel pixel to color: green  
    wait 300 milliseconds  
    stop strip effect
```