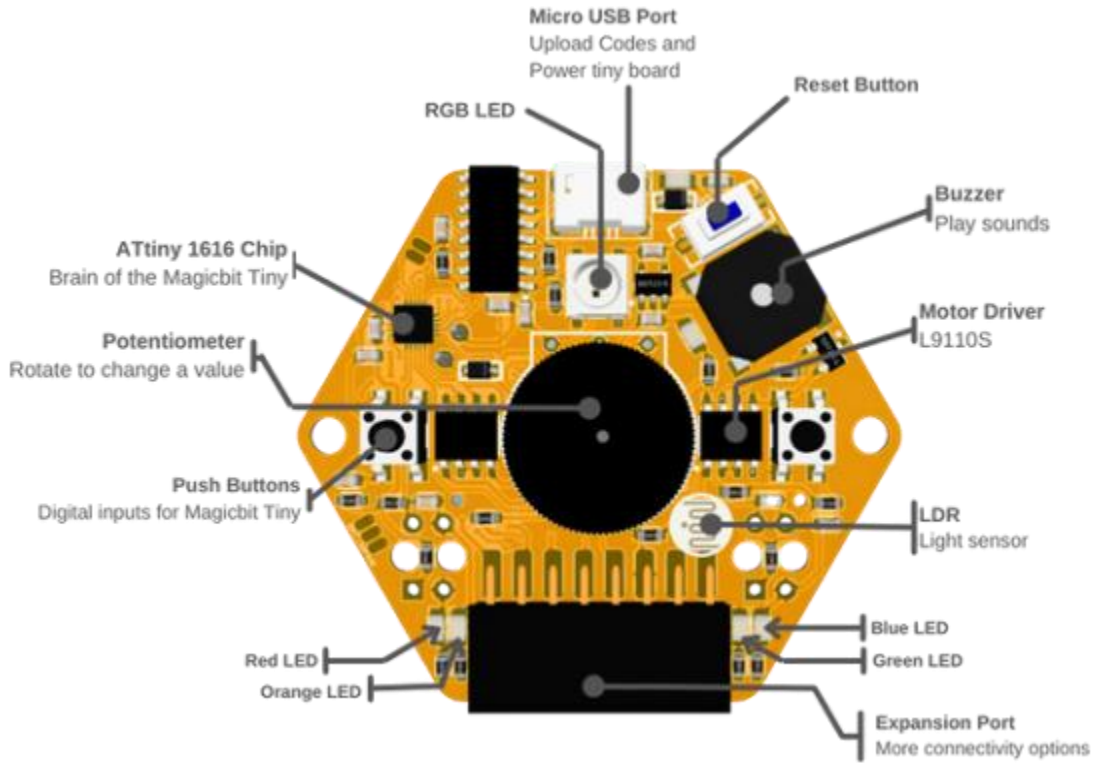# Magicbit Tiny with Scratch

- **Learning Outcomes: -**
  - Basic programming in Scratch
  - Magicbit Tiny associated activities
  - Creative hands-on projects using simple craft materials

- **Lessons Outline**

Lesson Number	Lesson Name
01	Introduction to Scratch
02	Light Show
03	Move Sprites
04	Dimmer Magic
05	Secret Message
06	Day - Night Predictor
07	Night Light
08	Anti-theft + fire detector
09	Automatic Rail gate
10	People Count
11	DIY Sensor

Magicbit Tiny Layout

Micro USB Port
Upload Codes and
Power tiny board

RGB LED

Reset Button

Buzzer
Play sounds

ATtiny 1616 Chip
Brain of the Magicbit Tiny

Motor Driver
L9110S

Potentiometer
Rotate to change a value

Push Buttons
Digital inputs for Magicbit Tiny

LDR
Light sensor

Red LED

Orange LED

Blue LED

Green LED

Expansion Port
More connectivity options

Magicbit Tiny Pinout

IR	A6,A5
RGB LED	0
Red LED	4
Orange LED	5
Green LED	10
Blue LED	11
Left button	12
Right button	9
Buzzer	13
POT	A3
LDR	A7
Motor 1	4/5
Motor 2	10/11

MPWR 5V 3.3V RST D8 GND M2A M1A
D4 D5 D10 D11 A1 A2 M2B M1B
SDA SCL
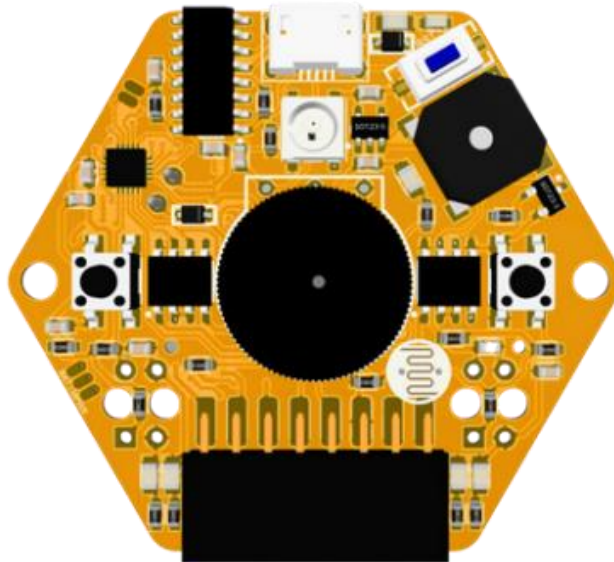
01 - Introduction to Scratch

- Activity
  - Simple scratch program to blink LEDs in Magicbit Tiny

- Learning Outcomes
  - Scratch / MagicCode Platform
  - Basics of the Scratch programming
  - LED controlling with digital signals

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
 - MagicCode Platform

- Steps for the Activity

  Expected Output - https://youtu.be/5diwtSEepAA

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0

  - **Step 02** - Connect the Magicbit Tiny to the computer and with MagicCode via USB

    - Help Guide - https://youtu.be/pTwA3AFiCVA

  - **Step 03** - Use one of the program running methods in Scratch **"Events"** category

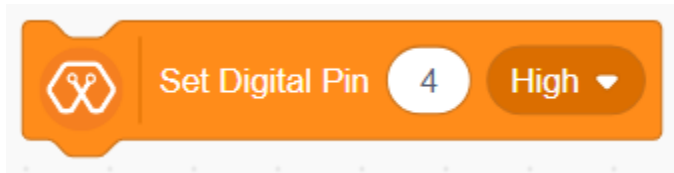   1. By clicking on the **''Green Flag''**

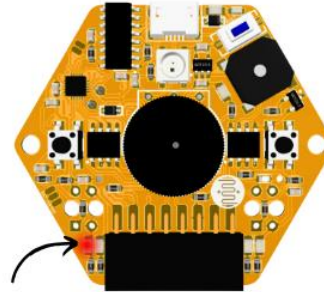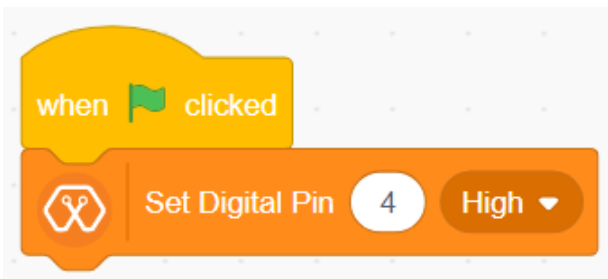   2. By clicking on the **sprite** in the stage
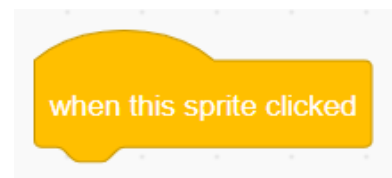
3. By pressing any or specified **key in the keyboard**
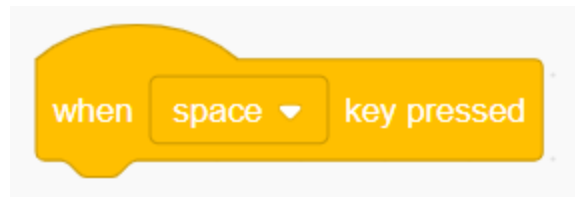
○ **Step 04 -** Use the below block in the **"Magicbit Tiny"** category to blink the LEDs.
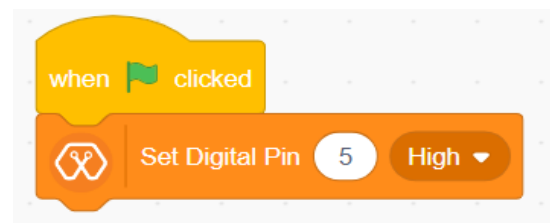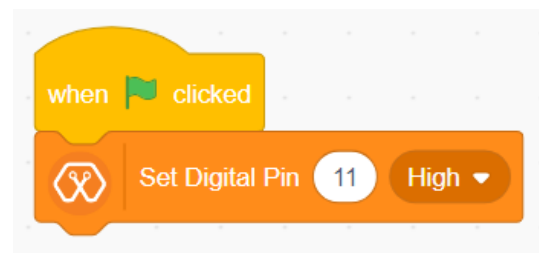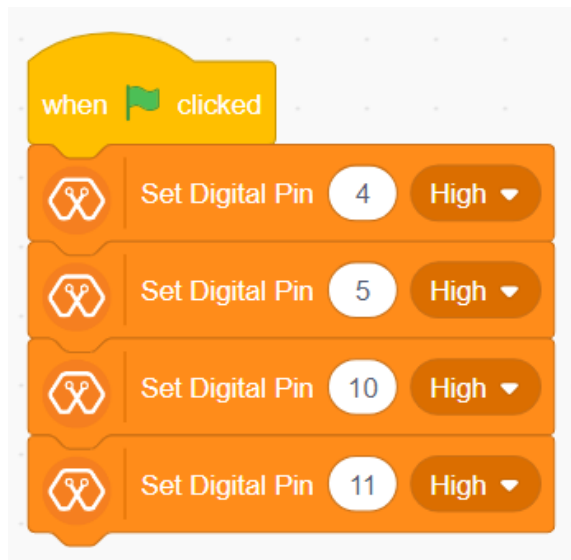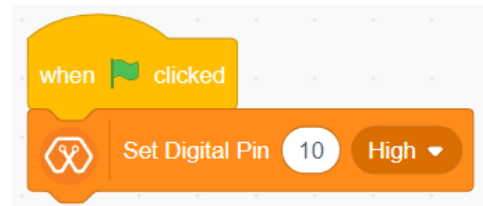

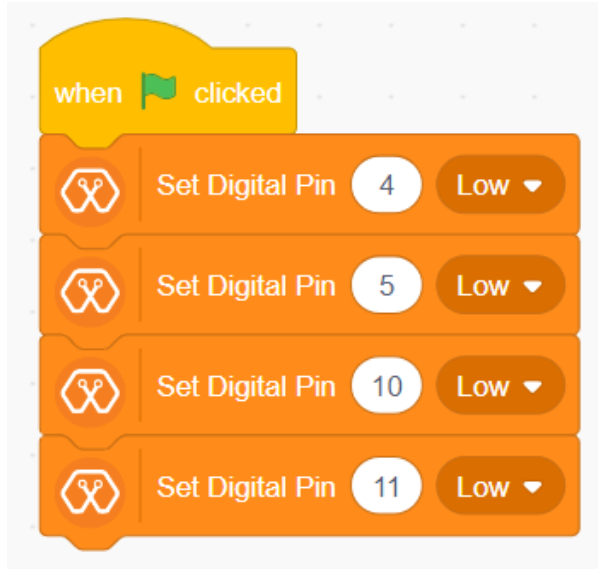○ **Step 05 -** Make the below code to light up the **RED** LED in the Tiny board

○ **Step 06 -** Change the pin numbers for other LEDs
- Yellow/Orange - 5
- Green - 10
- Blue - 11

○ **Step 07 -** Change the status to off the LEDs

when 🚩 clicked

Set Digital Pin 4 Low ▼

Set Digital Pin 5 Low ▼

Set Digital Pin 10 Low ▼

Set Digital Pin 11 Low ▼

02 - Light Show

- Activity
  - Scratch programming to create light patterns

- Learning Outcomes
  - **"Loops"** in programming
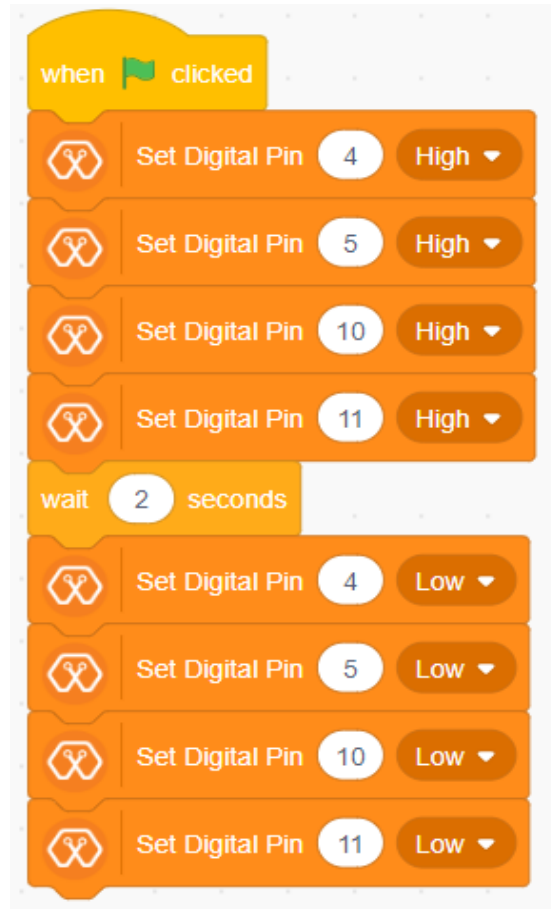 - Patterns from LEDs

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform

- Steps for the Activity

    Expected Output - https://youtu.be/ZYS_e6YxRCg

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0

  - **Step 02** - Connect the Magicbit Tiny to the computer and with MagicCode via USB

    - Help Guide - https://youtu.be/pTwA3AFiCVA

  - **Step 03 -** Make the program to turn on all 4 LEDs and then turn off them after few seconds

- **Step 06 -** Try different Patterns - https://youtu.be/J8UhgEjXZqg

03 - Move Sprites

- Activity
  - Simple scratch program to control sprites with Magicbit Tiny push buttons

- Learning Outcomes
  - Functioning of the push buttons
  - Handling sprites in scratch with push buttons

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
 - MagicCode Platform

- Steps for the Activity

Expected Output - https://youtu.be/vCxX03kPwR4

- **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit
  Tiny

- **Step 02 -** Push buttons in magicbit tiny
  - Pin numbers
    - Right button - pin 9
    - Left button - pin 12
    - The block which uses to handle the push buttons in tiny
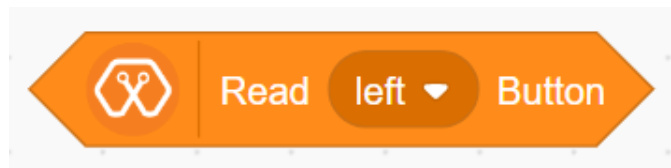
- ○ **Step 03 -** Run block and see how the readings vary with the button pressings
  - ■ When the button pressed - True
  - ■ When button is not pressed - false

- ○ **Step 04 -** Make the below code for any sprite to move it along the stage using push buttons in the Magicbit Tiny
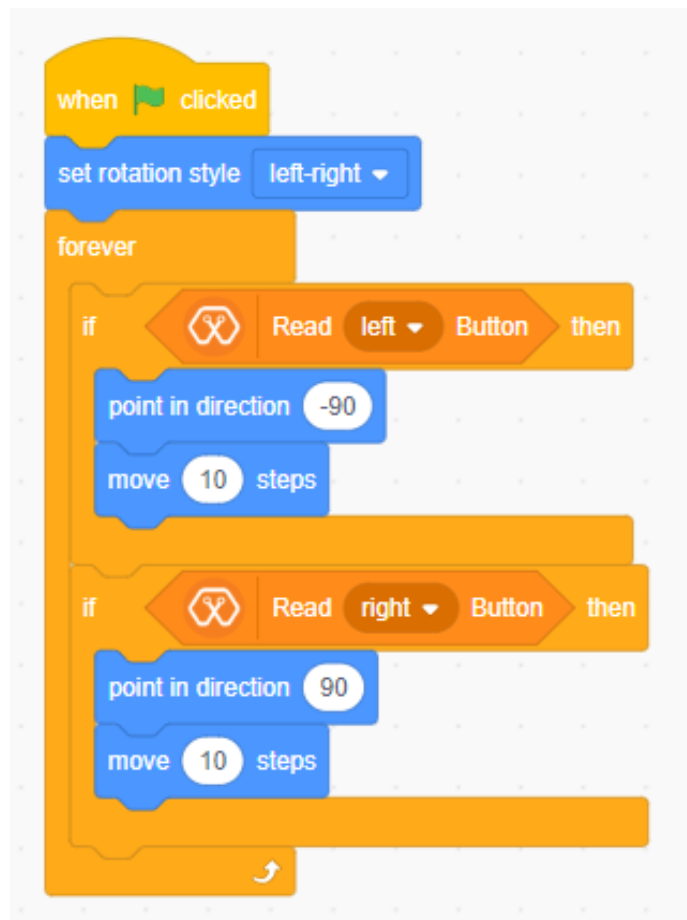
○ **Step 05 -** Create a program to control the LEDs using push buttons

■ LEFT side LEDs (Red and Orange) when the Left Push button is pressed.

■ RIGHT side LEDs (Blue and Green) when the Right Push button is pressed.

04 - Dimmer Magic

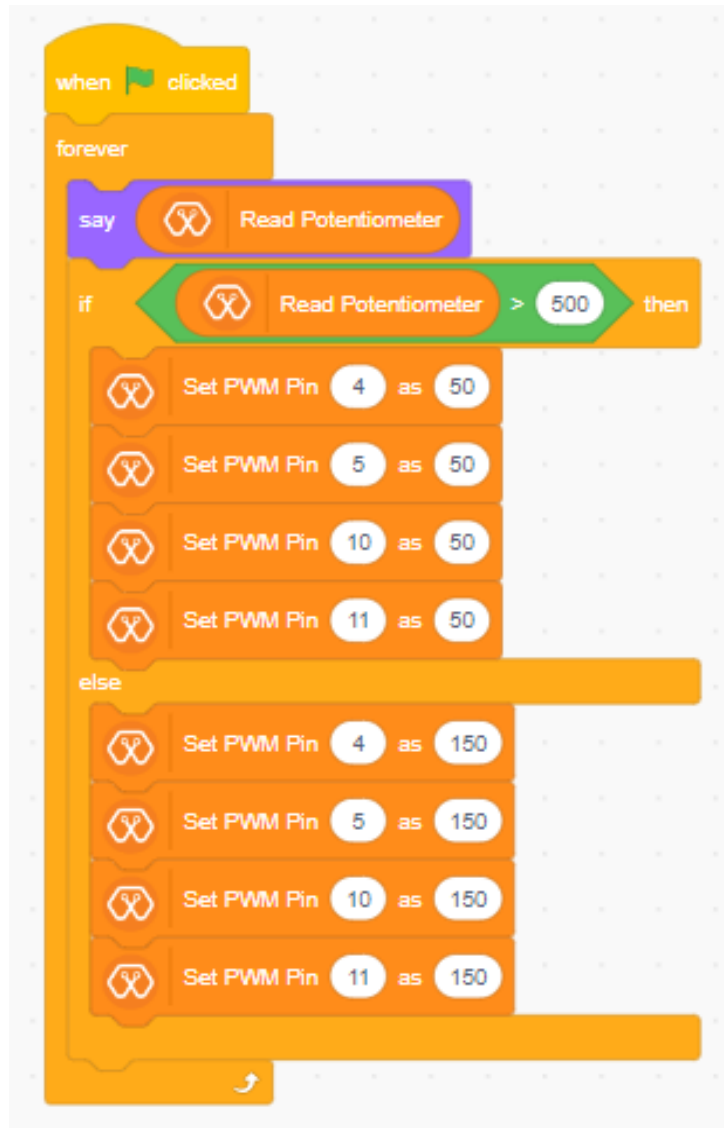- Activity
  - Create a simple program to control the brightness of the LEDs using the Potentiometer

- Learning Outcomes
  - Practical applications of basic electronic circuits
  - Creativity and Innovation

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform

- Steps for the Activity

  Expected Output – https://youtu.be/LWfj0KK7BGE

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny

  - **Step 02 -** Make the below program to control the brightness of the on-board red LED according to the Potentiometer value
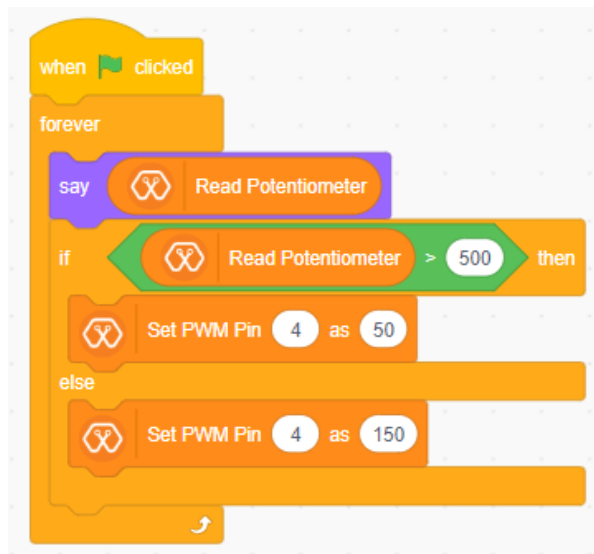
○ **Step 03 -** Update above program to control all 4 LEDs

```
when 🚩 clicked
forever
    say ⊗ Read Potentiometer
    if ⊗ Read Potentiometer > 500 then
        ⊗ Set PWM Pin 4 as 50
        ⊗ Set PWM Pin 5 as 50
        ⊗ Set PWM Pin 10 as 50
        ⊗ Set PWM Pin 11 as 50
    else
        ⊗ Set PWM Pin 4 as 150
        ⊗ Set PWM Pin 5 as 150
        ⊗ Set PWM Pin 10 as 150
        ⊗ Set PWM Pin 11 as 150
```

05 - Morse Code Messaging

- Activity
  - Create a simple program to display a password / morse code using LEDs and sound output using buzzer

- Learning Outcomes
  - Practical applications of basic electronic circuits
 - Creativity and Innovation
  - Functioning of the Buzzer

- Materials Required
  - Magicbit Tiny Board
  - USB cable
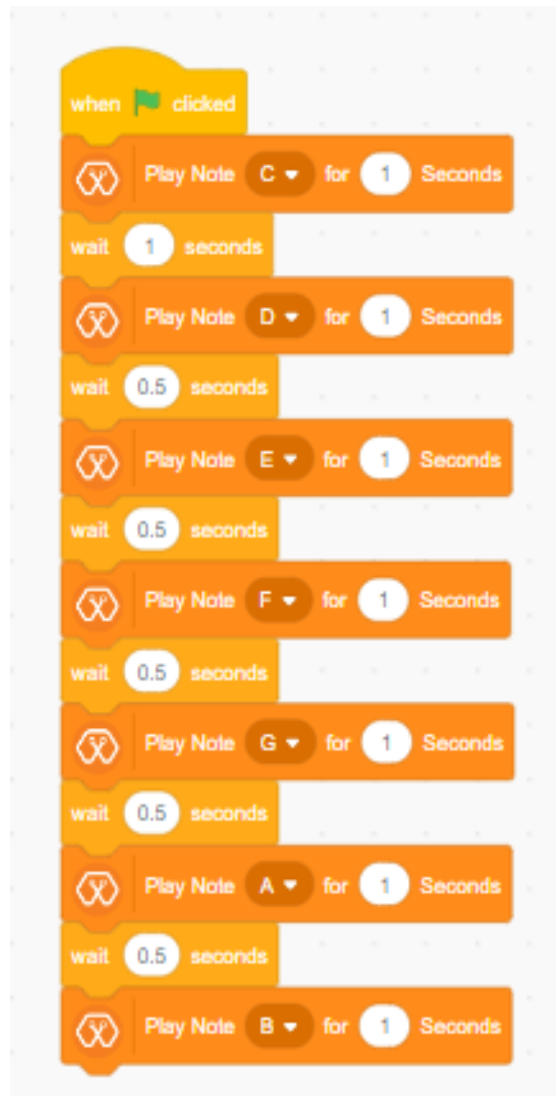 - Computer with Internet Connection
  - MagicCode Platform

- Steps for the Activity

  Expected Output - https://youtu.be/J1nFBHAuzAg

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny

  - **Step 02 -** These are the blocks which can be used to function the buzzer
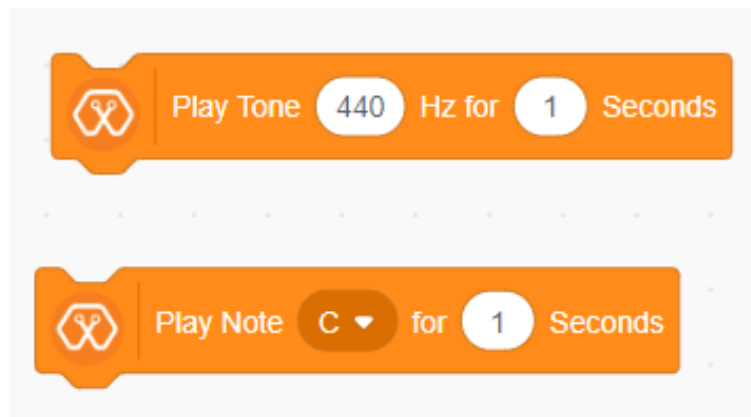
○ **Step 03 -** Create a program for a simple musical piece using above blocks as follows

○ **Step 04 -** Make the code to display a pattern in the LEDs while making a different tone for each output.

06 - Day / Night Predictor

- Activity
  - Create a simple program for an scratch animation to indicate day and night according to the environmental light condition

- Learning Outcomes
  - Creativity and Innovation
  - Functioning of the LDR
  - Animations in scratch

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform

- Steps for the Activity

  Expected Output - https://youtu.be/0czwEVSYptU

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
  - **Step 02 -** Make the scratch animation background which looks like a day time and night time
    - Add any backdrop which looks like Day Time (Eg:- Colorful City)
    - Add any backdrop which looks like the Night time (Eg:- Night City)
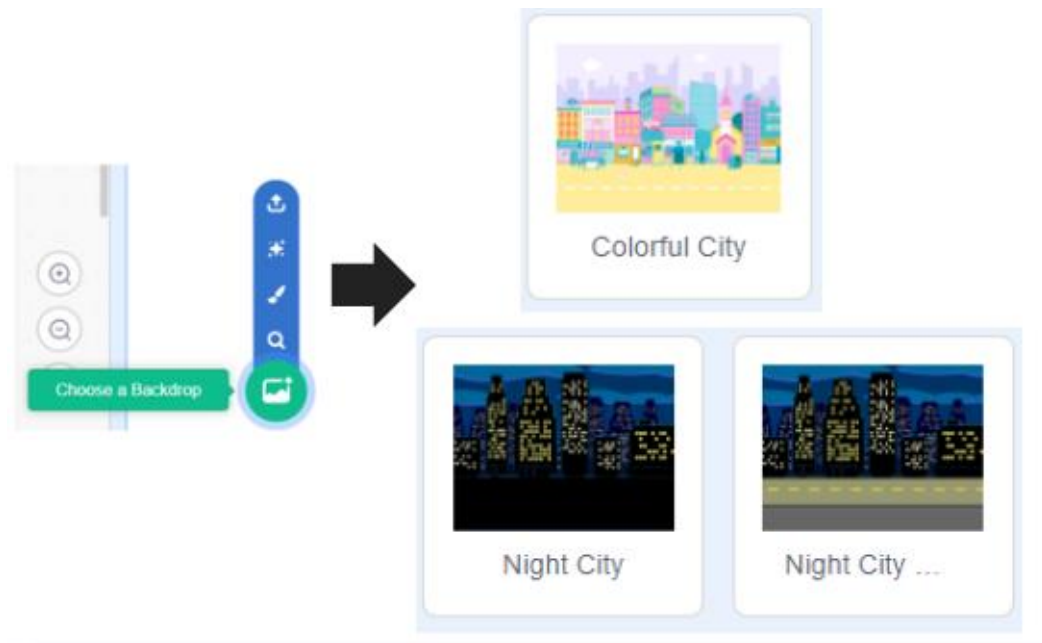
■ Delete the default sprite and select a suitable sprite

○ **About the LDR**

■ What is LDR - LDR (Light Dependent Resistor) is a sensor which can be used to measure the light intensity in the environment.

■ The below block in the "Magicbit Tiny" category can be used to get the readings from the Magicbit Tiny LDR
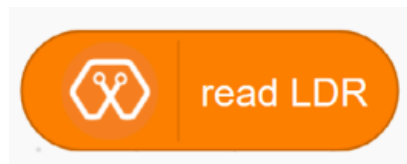
○ **Step 04 -** Make a simple program to get the reading from Magicbit Tiny LDR and display it on the MagicCode stage

○ **Step 05 -** Update the above program to switch between the backdrops selected earlier according to the LDR reading
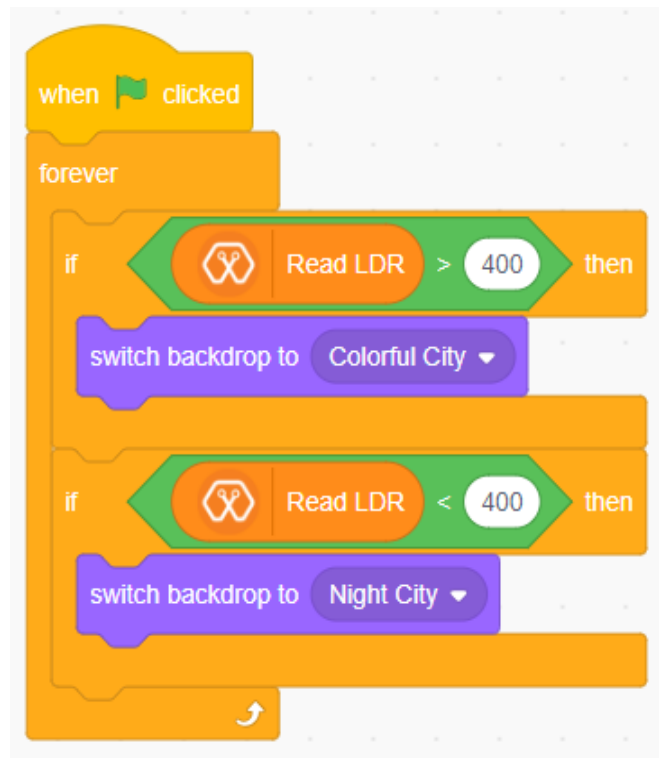
07 - Night Light

- Activity
  - Create a simple program to activate a light bulb (LED / RGB) according to the environmental light condition

- Learning Outcomes
  - Practical applications of basic electronic circuits
  - Creativity and Innovation
  - Functioning of the LDR

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
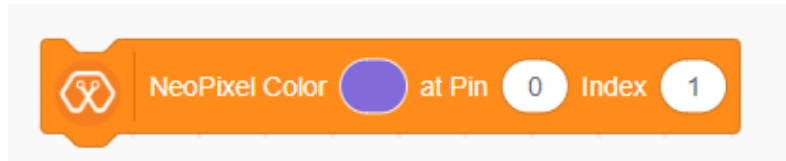 - MagicCode Platform

- Steps for the Activity

  Expected Output - https://youtu.be/g1bGuv1lukQ

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
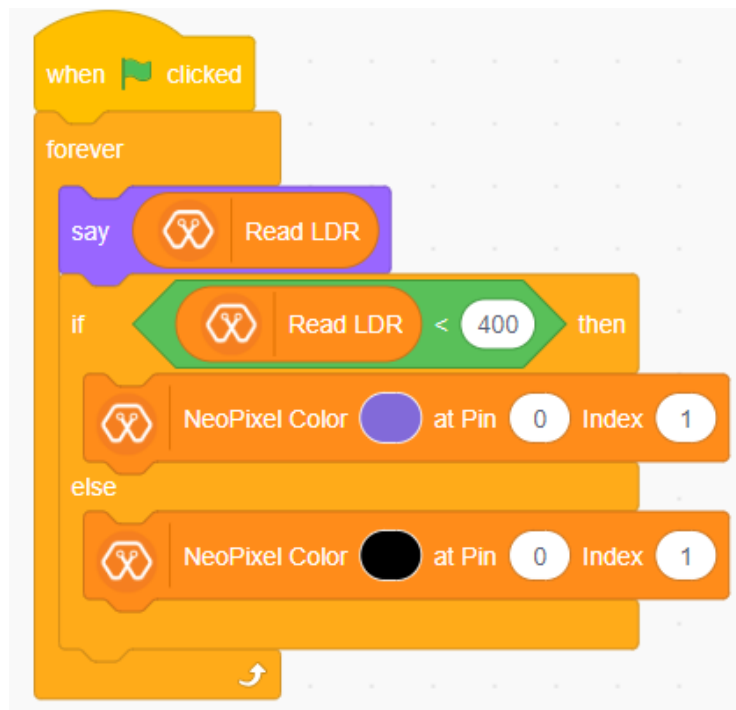 - **Step 02 -** Make a program to read the light condition inside your room
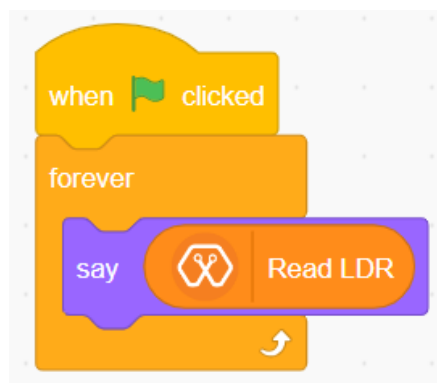
○ **Step 04 -** Update the program to activate the RGB LED in the Magicbit Tiny according to the measured LDR value.

- These are the blocks used in MagicCode to activate RGB LED

NeoPixel Color R `100` G `100` B `100` at Pin `0` Index `1`

NeoPixel Color ⬤ at Pin `0` Index `1`

- Make the program and test

when 🚩 clicked

forever

  say ⊗ Read LDR

  if ⊗ Read LDR < `400` then

    NeoPixel Color ⬤ at Pin `0` Index `1`

  else

    NeoPixel Color ⬤ at Pin `0` Index `1`

- Adjust the program for different colors in different LDR reading ranges

08 - Anti-Theft

- Activity
  - Create a simple program to activate an alarm from the buzzer when a movement is detected by the IR sensors

- Learning Outcomes
  - Practical applications of the concepts
  - Creativity and Innovation
  - Functioning of the proximity IR sensors

- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
 - MagicCode Platform

- Steps for the Activity

  Expected Output - https://youtu.be/NEFo_9V7h3s

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny

  - **Proximity IR sensors**
    - In back side of the Magicbit Tiny
    - Connected to pin A5 and A6
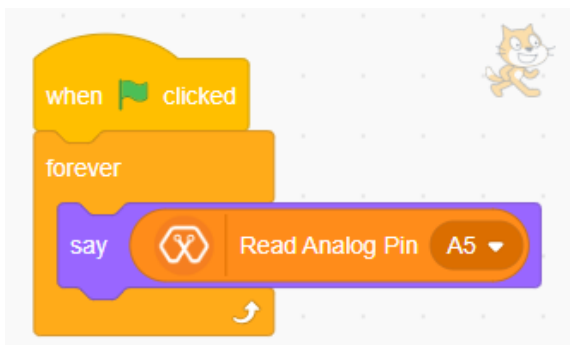   - The block used in MagicCode for IR sensor reading is,
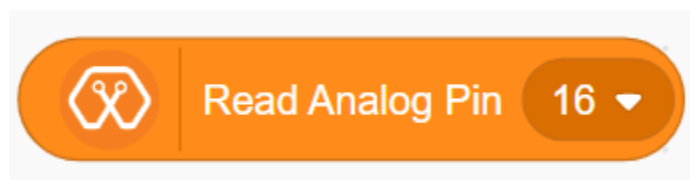
○ **Step 03 -** Make a program to get the readings from both IR sensors in the Magicbit Tiny

■ Add two sprites
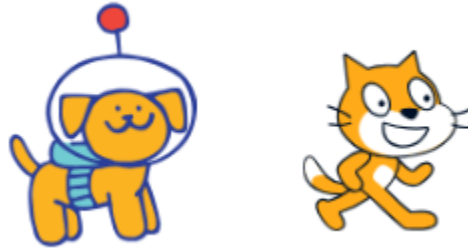
■ Make the program as one sprite to display the reading from one IR sensor
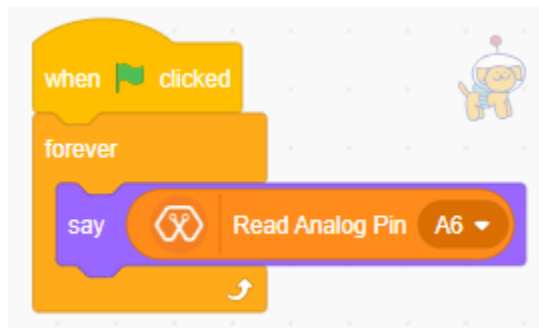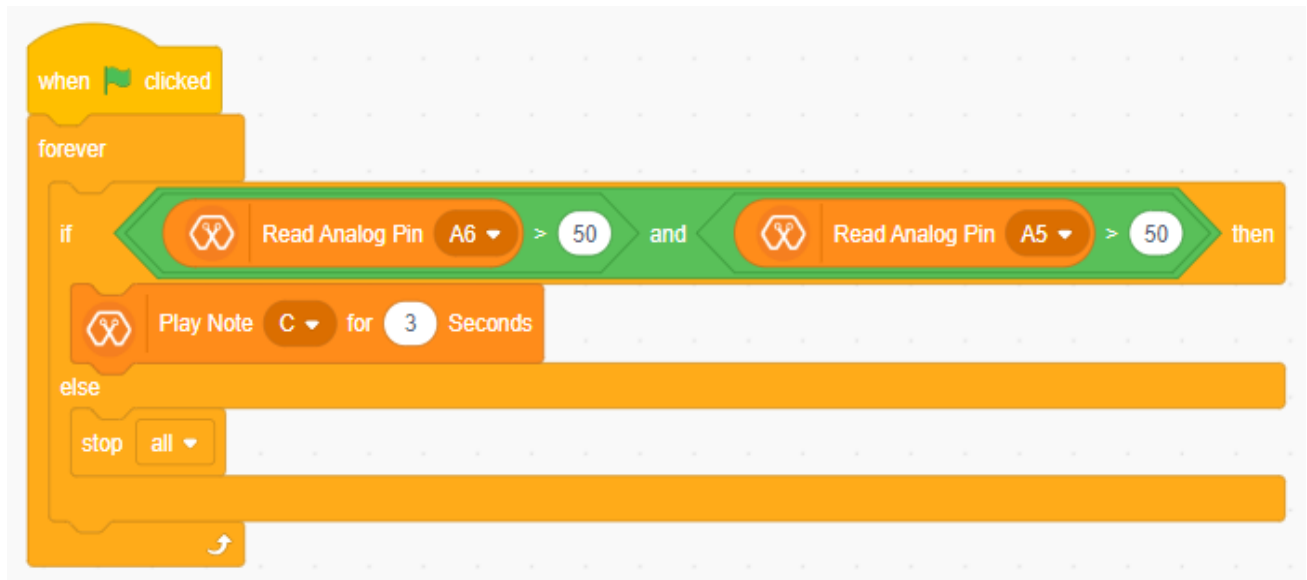

○ **Step 04 -** Update the above program (use only one sprite) to activate the buzzer according to the readings from IR sensors

■ Here the **"AND"** and **"OR"** operators can be used.

■ Use AND operator and make the program

● Try - Update the program to make a fire detector

○ IR sensors for detection
○ Change the conditions for IR readings

09 - Rail Gate

- Activity
  - Create a simple program to activate the servo motor as the rail gate when as motion detected by the Proximity IR sensors
- Learning Outcomes
  - Practical applications of the concepts
  - Creativity and Innovation
  - Functioning of the proximity IR sensors
  - Functioning of the servo motors
- Materials Required
  - Magicbit Tiny Board
  - Tiny extension module
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform
  - Servo motor
- Steps for the Activity

  Expected Output - https://youtu.be/gxgTAXWFNac

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
 - **Step 02 -** Fix the wooden servo arm with the servo motor (Here the wooden arm works as the rail gate)
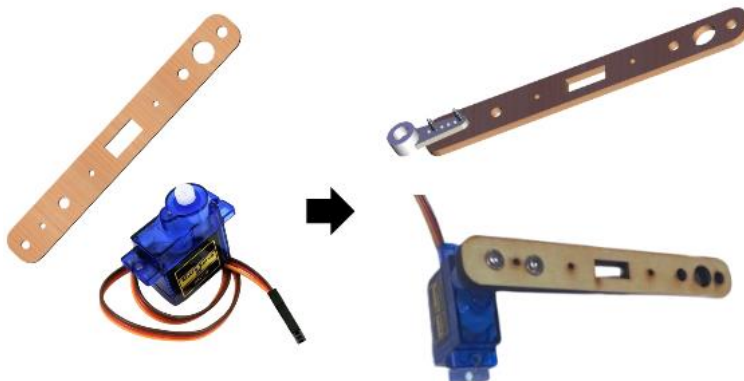
- ○ **Step 03 -** Connect the servo motor cable with tiny extension pin 8
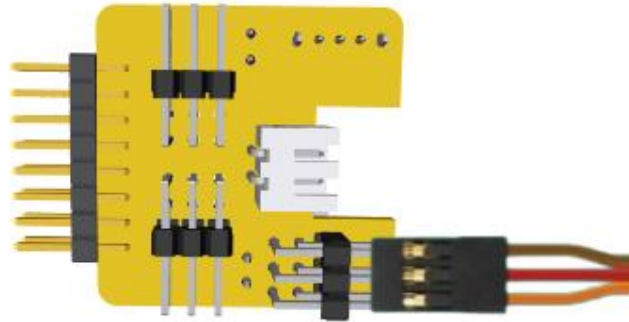
- ○ **Step 04 - Connect the extension module with the Magicbit**
- ○ **Step 05 -** Power the Extension with the battery while the Magicbit Tiny is connected to the computer via USB
- ○ **Step 08 -** Make the below program to figure out the required servo motor angles.
    - Enter the pin number as 8
    - Check with different angles from 0 - 180
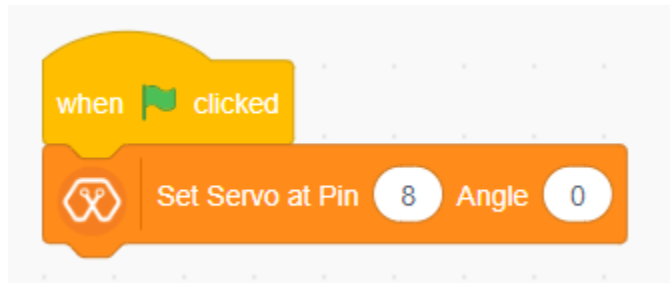
- ○ **Step 09 -** Make the program to operate the servo motor according to the motion detected by the IR proximity sensor in the Magicbit Tiny.
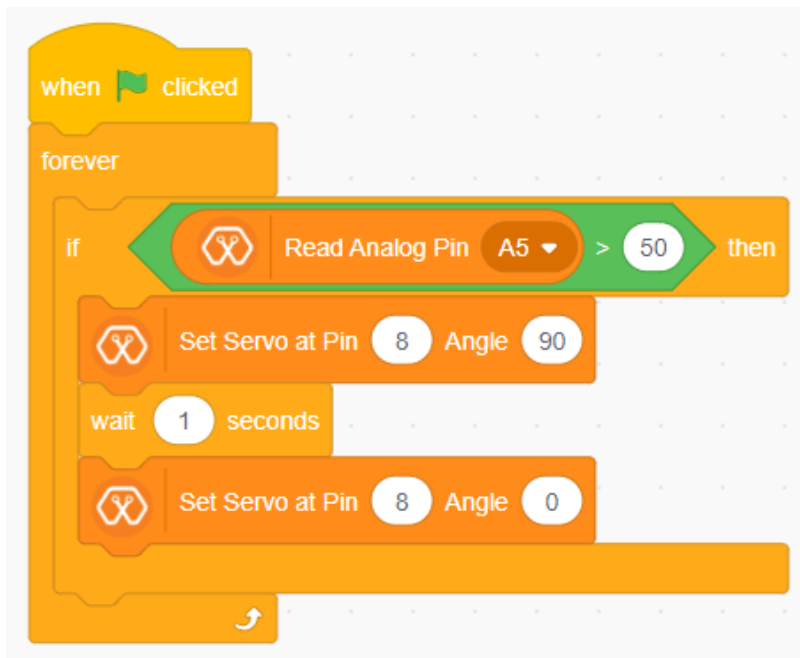
Lesson 10 - People Count

- Activity
  - Create a simple program to count the no.of people (motions) entering through a door and going out from the door when a motion is detected by the Proximity IR sensors.
- Learning Outcomes
  - Practical applications of the concepts
  - Creativity and Innovation
  - Functioning of the proximity IR sensors
  - Variables in programming
- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform
- Steps for the Activity

  Expected Output - https://youtu.be/c93mD88_Z3g

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
  - **Step 02** - Make the scratch interface by adding a suitable backdrop and sprite
  - **Step 03 -** Create two variables as **"People In''** and **"People Out''**
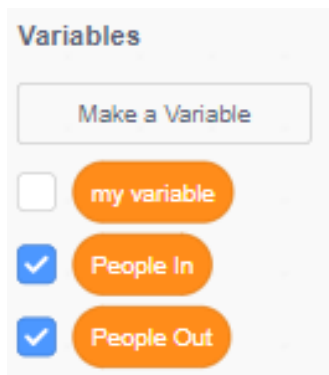
○ **Step 04 -** Make the program to update the created variables according to the motions from IR sensors

Lesson 11 - DIY Sensors

- Activity 01 - DIY Conductivity Sensor
  - Create a simple program to indicate the conductivity of different materials as a Neo-pixel indicator using the Magicbit Tiny.
- Learning Outcomes
  - Practical applications of the concepts
  - Creativity and Innovation
  - Functioning of RGB LEDs
- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform
  - M-M jumper cables
  - Different types materials (Paper , rubber , metal , copper)
- Steps for the Activity

  Expected Output - https://youtu.be/eSGc3KKRuIE

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
  - **Step 02 -** Connect one jumper wire to the ground pin and one jumper wire to the D8 pin of the Tiny board.
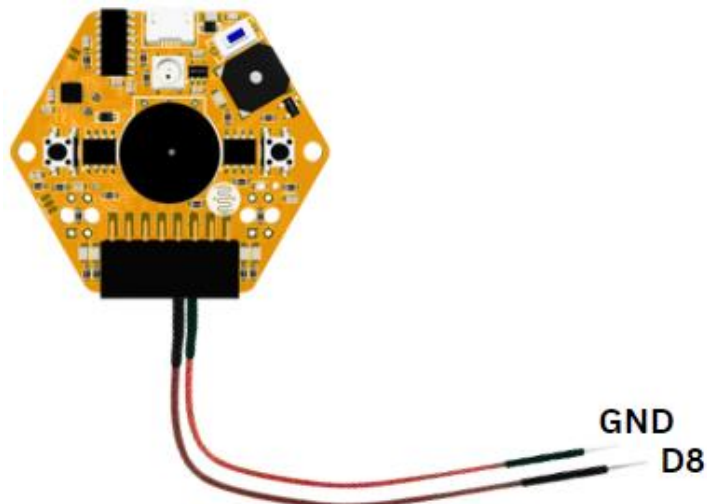
○ **Step 03 -** Make the program to indicate the conductivity level in different colors of the RGB.

High Conductivity

Moderate Conductivity

Lower Conductivity

Very Low Conductivity

Minimal Conductivity

- Activity 02 - DIY Soil Sensor

  - Create a program to indicate the different moisture levels in the soil using the Neopixel indicator in the Magicbit Tiny.

    - Same program and same set up as in Activity 01 above.

    - Insert the free ends of the jumper cables to a soil sample to get the results through Neo-pixel (RGB) LED.

  -

- Activity 03 - DIY Color Sensor

  - Create a simple program to detect the ambient light's color using LDR and display it through a Neo-Pixel RGB LED using the Magicbit Tiny.

    - Step 01 - Make the below program to get the ambient light values from the LDR and according to those values, control the RGB color.