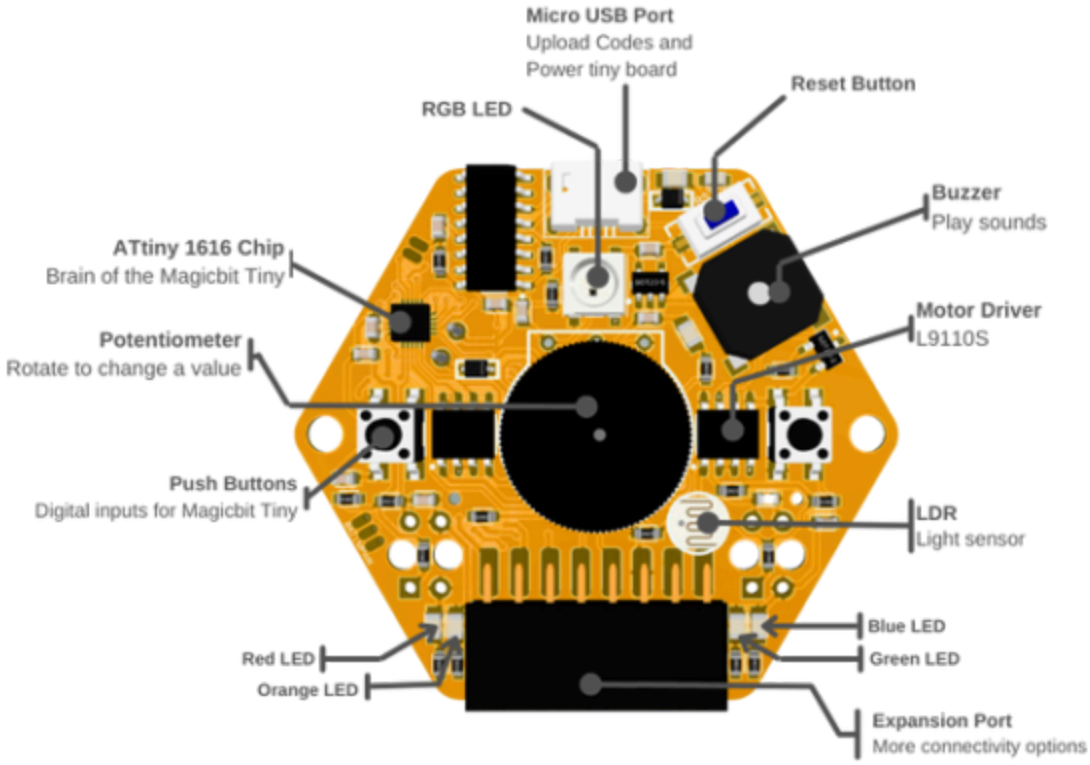
Level 1 : Introduction to Programming and Electronics with Magicbit Tiny and Scratch

- **Learning Outcomes :-**
  - Basic programming in Scratch
  - Magicbit Tiny associated activities
  - Creative hands-on projects using simple craft materials
- **Component Kit :-** Kit 01
- **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
12	DIY Hand Dryer

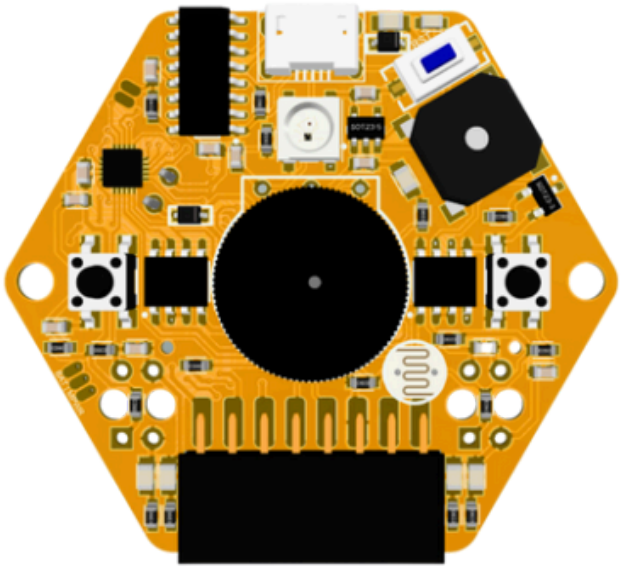
- **Time Duration :-** 1 - 1.5 hrs per lesson

Magicbit Tiny Layout



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



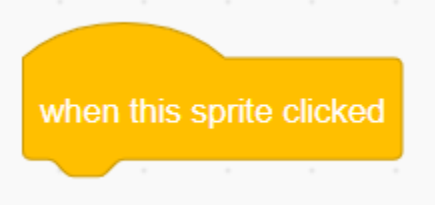
Lesson 01 - Introduction to Scratch

- 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

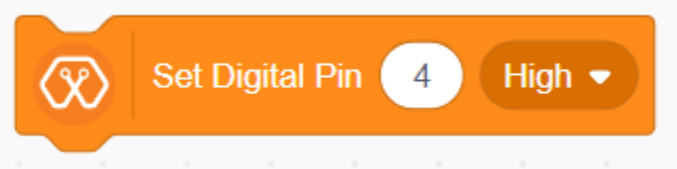
  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0
  - **Step 02** - Explain about the MagicCode / Scratch Interface
  - **Step 03** - Explain about the Magicbit Tiny board - LEDs
  - **Step 04** - Connect the Magicbit Tiny to the computer and with MagicCode via USB
    - Help Guide - https://youtu.be/pTwA3AFiCVA
  - **Step 05** - Describe program running methods in Scratch - **'' Events''** category
    1. By clicking on the **''Green Flag''**

    2. By clicking on the **sprite** in the stage

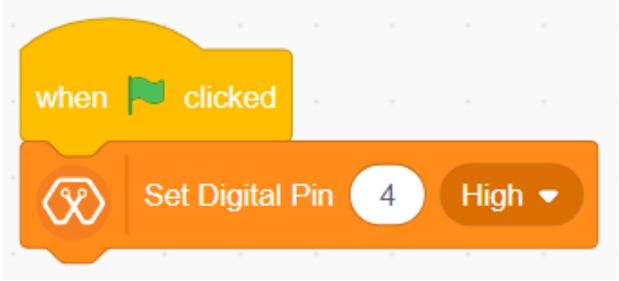


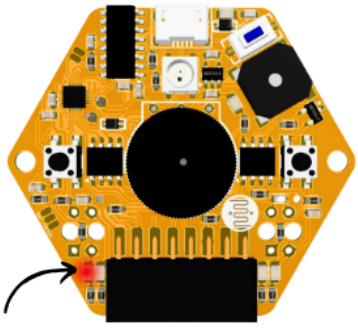
3. By pressing any or specified **key in the keyboard**

- **Step 06 -** Explain about the main activity - Blinking LEDs
- **Step 07 -** Explain the magicbit Tiny block category
- **Step 08 -** Highlight the below block which uses to blink the LEDs

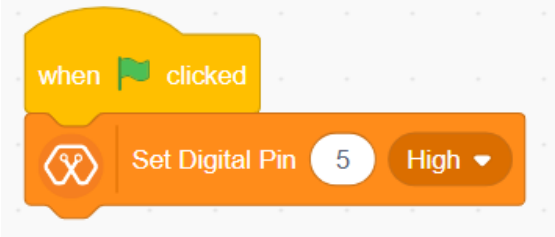


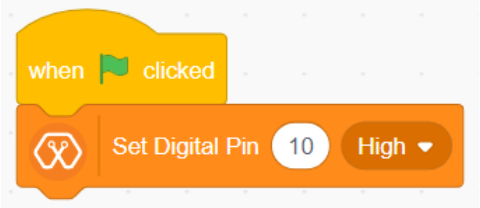
- **Step 09 -** Make the below code to light up the **RED** LED in the Tiny board

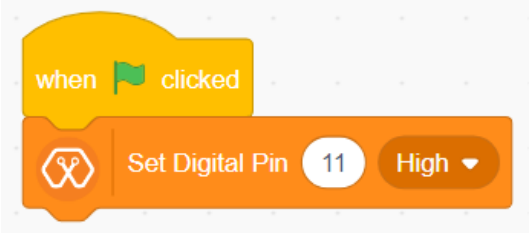


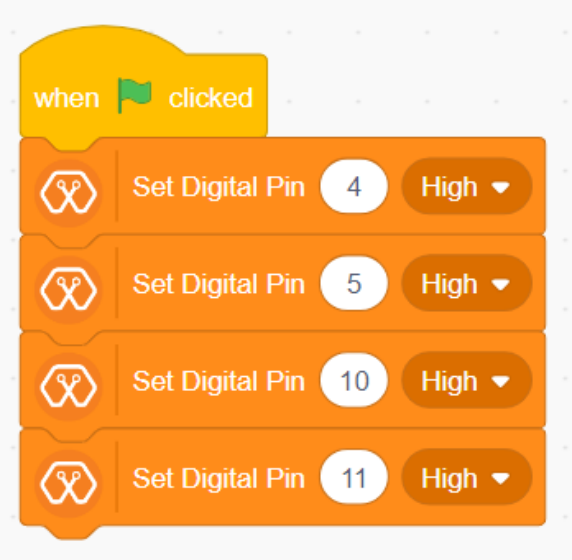


- **Step 10 -** Change the pin numbers for other LEDs
  - Yellow/Orange - 5
  - Green - 10
  - Blue - 11

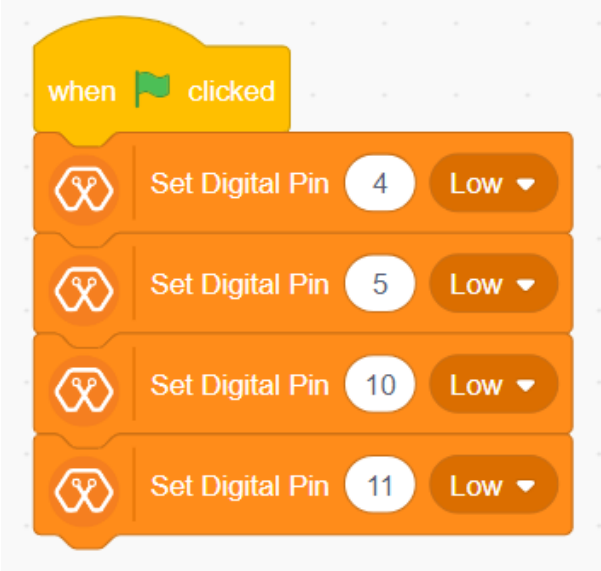








- **Step 11 -** Change the status to off the LEDs



Lesson 02 - Light Show

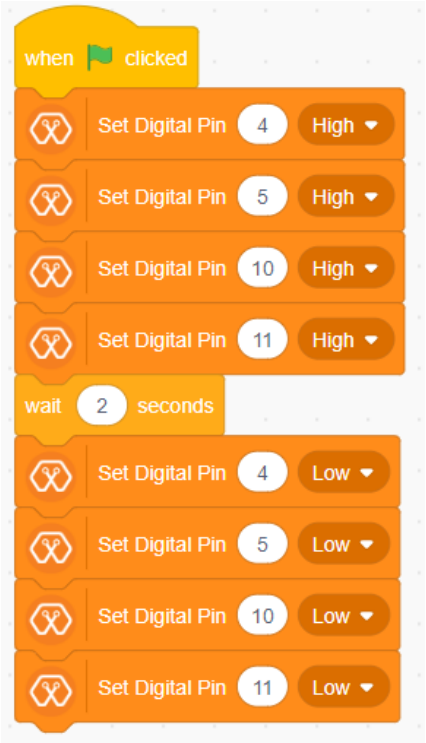
- Activity
  - Scratch programming with simple circuits to create light patterns
- Learning Outcomes
  - About breadboard
  - Simple electronic circuits creation
  - Simple circuits operation with scratch programs
- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform
  - Breadboard
  - M-M jumper wires
  - LEDs
  - Resistors
- Steps for the Activity - 1

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

  - **Step 01** - Explain about the Magicbit Tiny board - LEDs
  - **Step 02** - Get into the MagicCode platform → MagicCode 3.0
  - **Step 03** - Connect the Magicbit Tiny to the computer and with MagicCode via USB
    - Help Guide - https://youtu.be/pTwA3AFiCVA
  - **Step 04 -** Explain the about the **‘’wait”** block (To keep delays)

  - **Step 05 -** Make the program to turn on all 4 LEDs and then turn off them after few seconds

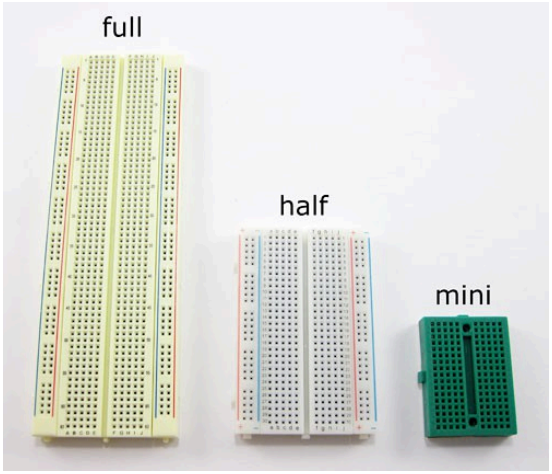


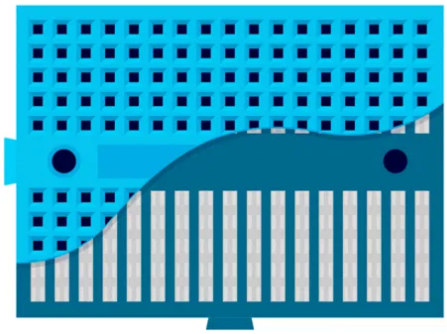
- **Step 06 -** Try different Patterns - https://youtu.be/J8UhgEjXZqg

- Steps for the Activity - 2

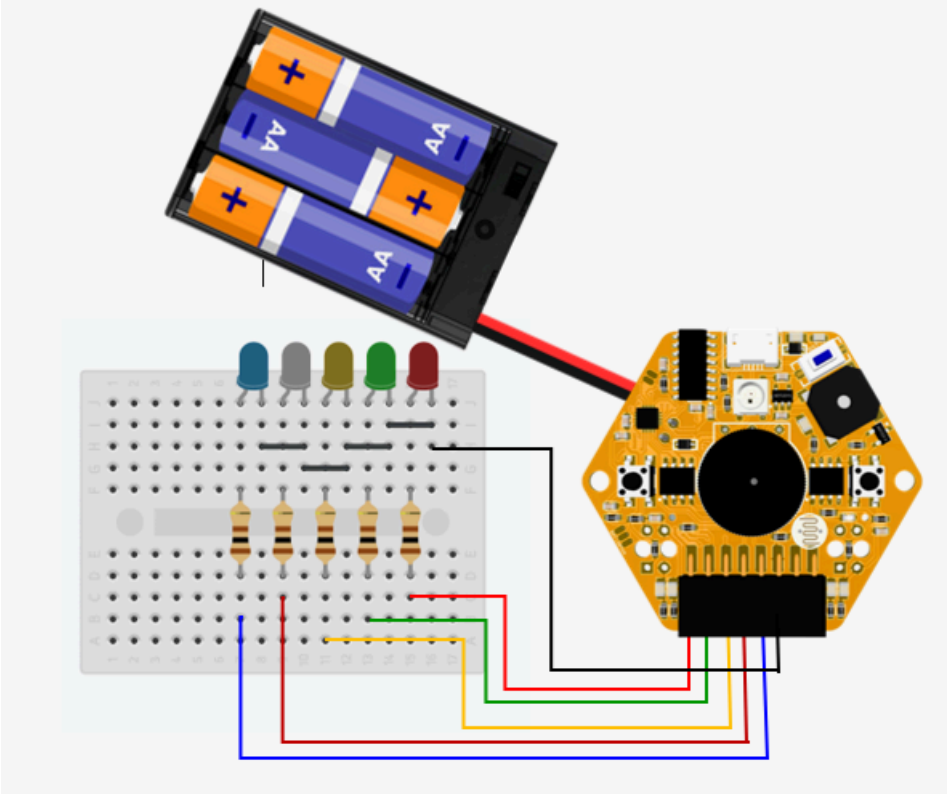
  Expected Output - https://youtu.be/F0J3DQ7STbA

  - **Step 01 -** Explain about the simple electronic circuits using breadboards
  - **Step 02** - Explain the connections in Breadboard





- **Step 03 -** Explain about the usage of resistors (use to control the current)
- **Step 04 -** Explain about the LEDs
- **Step 05 -** Make the below circuit using LEDs, resistors, jumper cables, breadboard, Magicbit Tiny



- **Step 06 -** Make the program to activate the LEDs
- **Step 07 -** Create different patterns and try.

Lesson 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

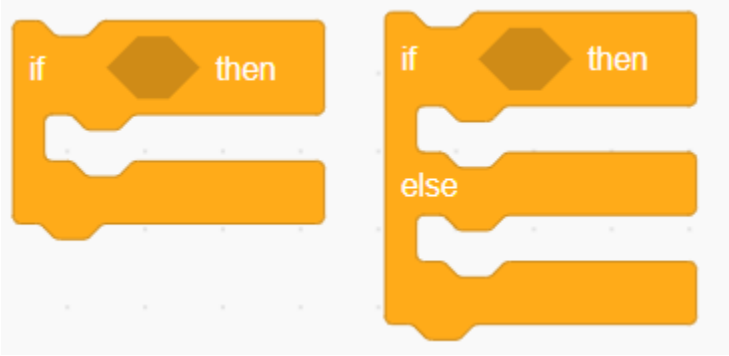
  Expected Output - https://youtu.be/vCxX03kPwR4

  - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
  - **Step 02 -** Recall about the sprites
  - **Step 03 -** Explain about the push buttons in general
  - **Step 04 -** Explain about the push buttons in magicbit tiny
    - Position
    - Pin numbers
      - Right button - pin 9
      - Left button - pin 12
  - **Step 05 -** Explain the block which use to handle the push buttons in tiny

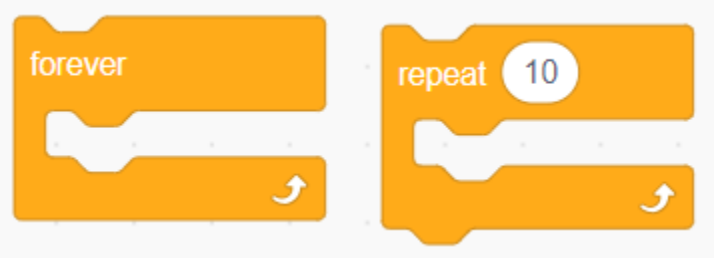
  - **Step 06 -** Run block and see how the readings vary with the button pressings
    - When the button pressed - True

- When button is not pressed - false

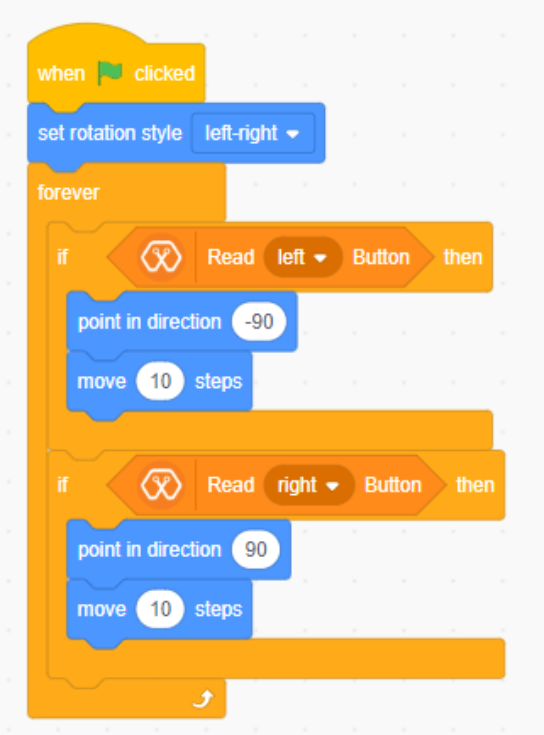
- **Step 07 -** Make the below code for any s
  using push buttons in the Magicbit Tiny
  - Explain about **''if-else''** function



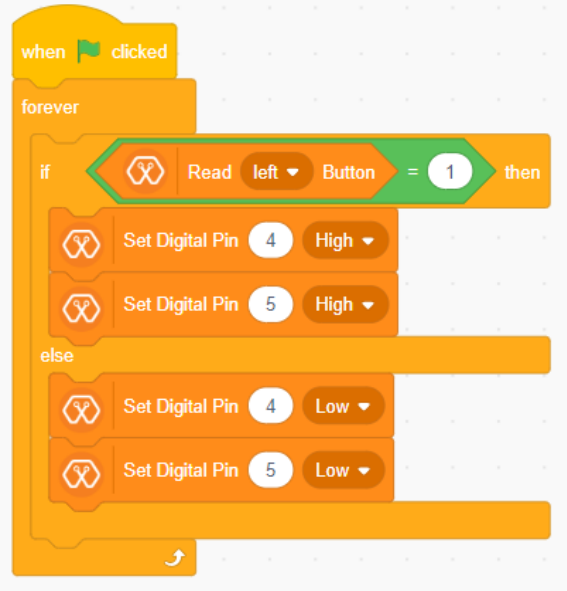
  - Explain about the loops - **forever and repeat** blocks



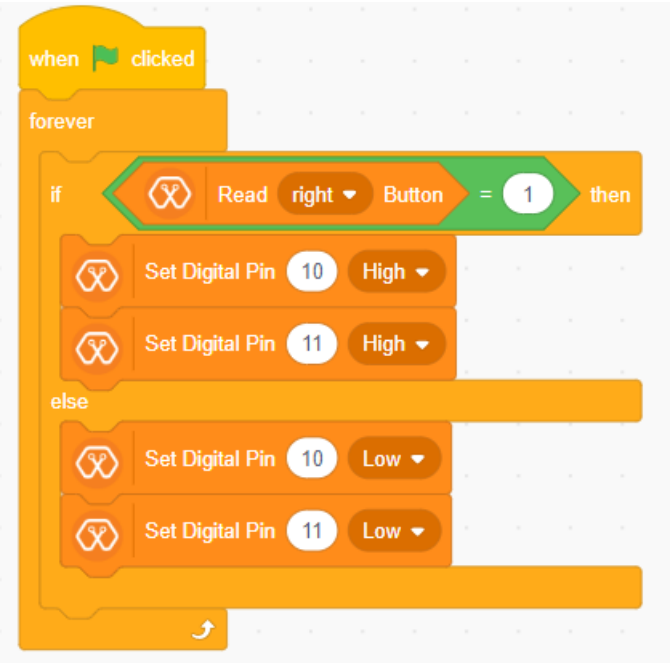
  - Create the below program and test with Magicbit Tiny push buttons



- **Step 08 -** 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 .

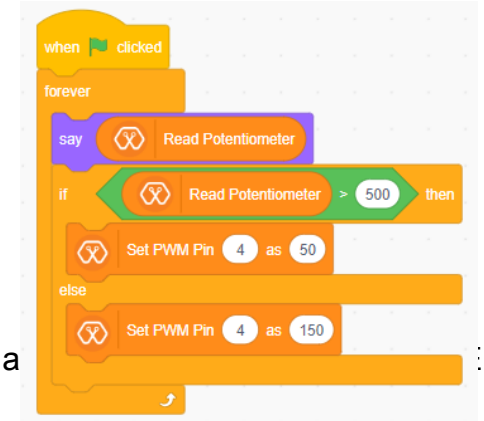


Lesson 04 - Dimmer Magic

- Activity
  - Create a simple table lamp structure and make the program to control it using MagicCode and Magicbit Tiny
  - Brightness of the lamp is controlled using 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
  - Cardboard
  - M-M jumper wires
  - Resistor connected LED
  - Hot glue gun with glue sticks
  - M-M jumper wires
- 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 -** Explain about the potentiometer and PWM concept
  - **Step 03 -** Make the below program to control the brightness of the on-board LEDs according to the Potentiometer value



  - **Step 04 -** Update a [illegible]Ds

- **Step 05 -** Make a simple lamp structure using cardboard as follows.

- **Step 06** - Connect the resistor connected LED to the structure as follows.

- **Step 04 -** Connect the LED cables with Magicbit Tiny
  - Red - one from 4 , 5 , 10 ,11
  - Black - GND
- **Step 05 -** Update the above program to the previous one to control one LED
- **Step 06 -** Check the output with Potentiometer controlling

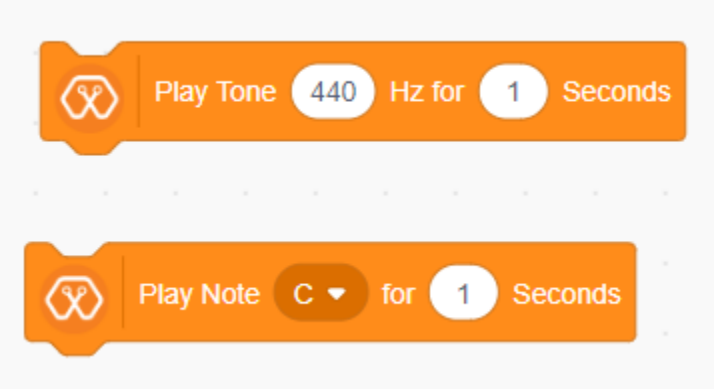
Expected Output - https://youtu.be/rZOLJAr0BSg

Lesson 05 - Morse Code Messaging

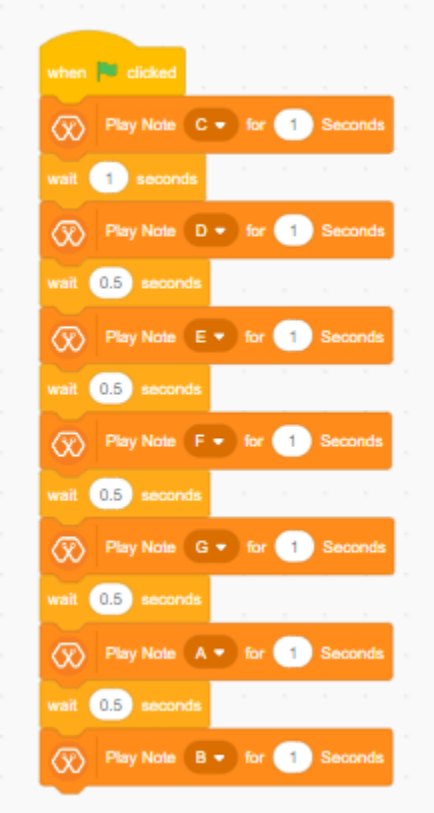
- Activity
    - Create a simple program to display a password / morse code using LEDs and buzzer
- Learning Outcomes
    - Practical applications of basic electronic circuits
    - Creativity and Innovation
    - Functioning of the Buzzer
- Materials Required
    - Magicbit Tiny Board
    - USB cable
    - Computer with Internet Connection
    - MagicCode Platform
    - M-M jumper wires
    - LEDs
    - 100 ohm resistors
- Steps for the Activity

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

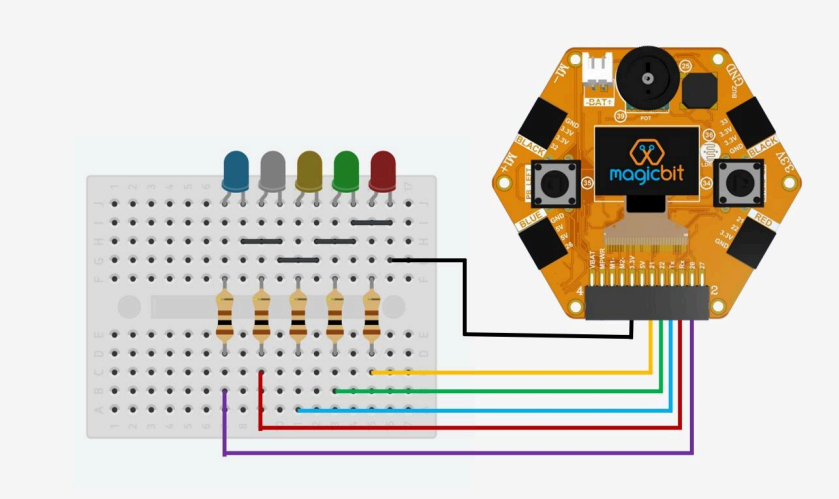
    - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
    - **Step 02 -** Explain about the buzzer
    - **Step 03 -** Explain the blocks used to function the buzzer



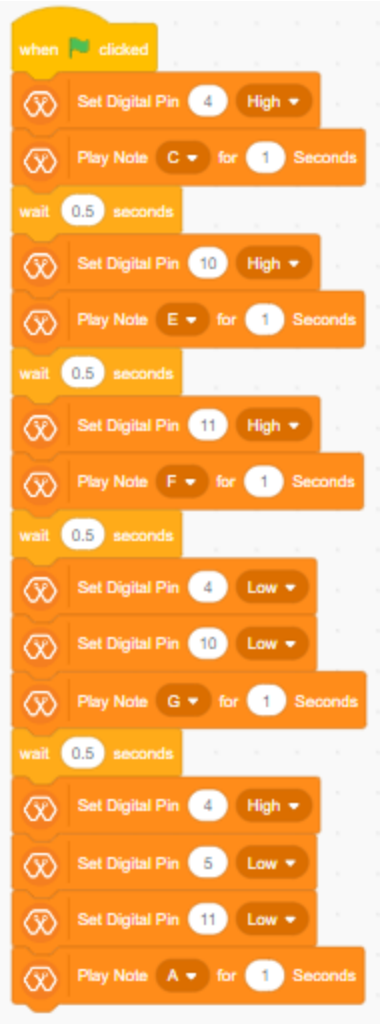
- **Step 04 -** Create a program for a simple musical piece using above blocks as follows



- **Step 05 -** Create a simple circuit with few LEDs to display the code



- **Step 06 -** Make the code to display a pattern in the LEDs while making a different tone for each output.



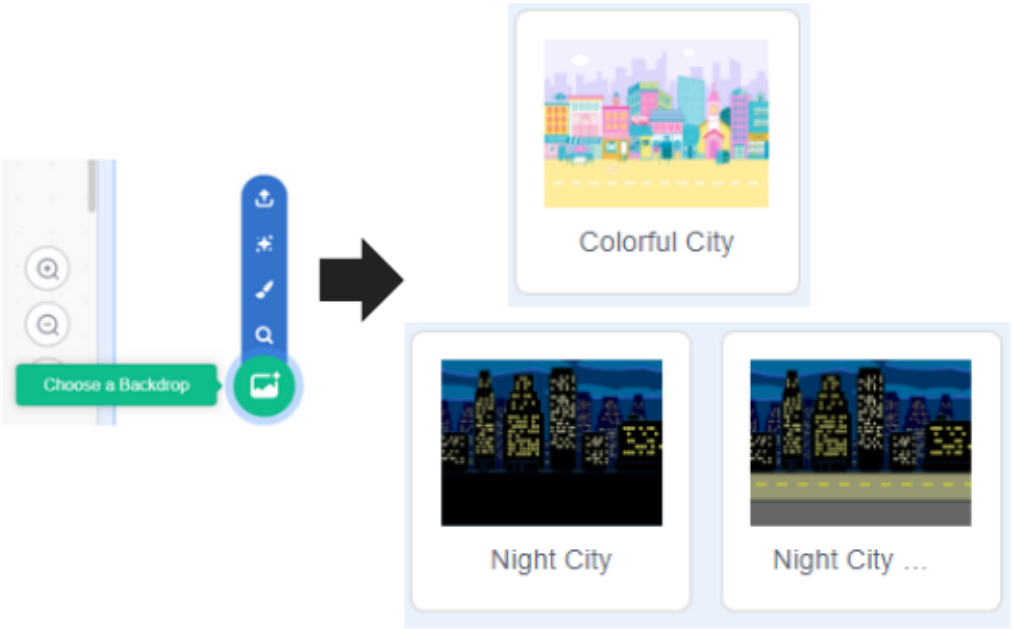
- **Step 07 -** Try different patterns

Lesson 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

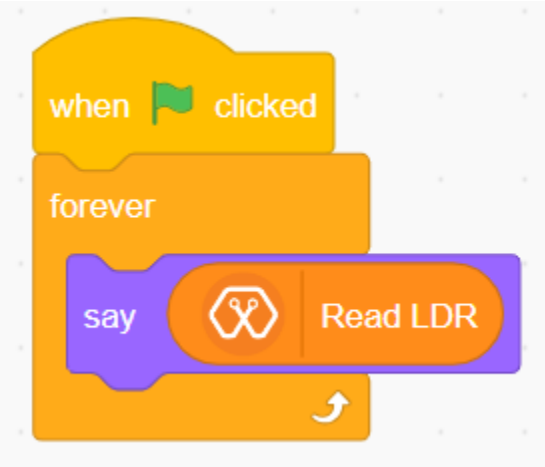
    - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
    - **Step 02 -** Make the scratch animation background which looks like a day time and night time
        - Add any backdrop which looks like Day Time (Eg: Colorful City)
        - Add any backdrop which looks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



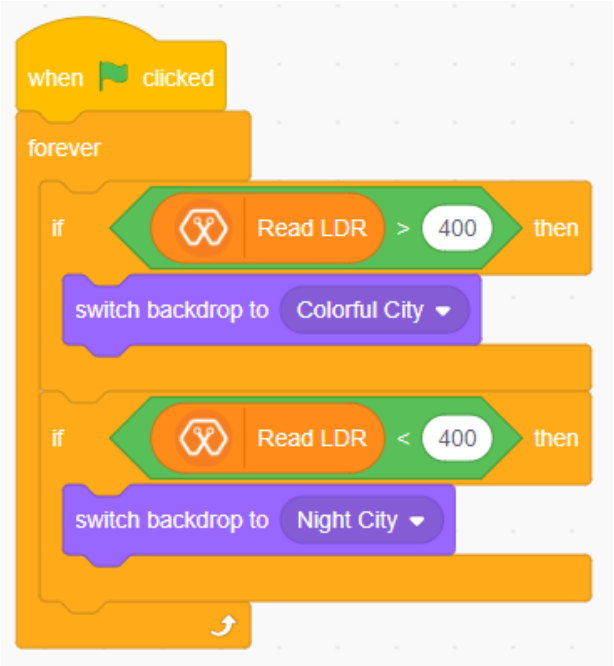
- Delete the default sprite and select a suitable sprite

- **Step 03 -** Explain about the LDR
  - What is LDR
  - How it measure light intensity
  - Block in MagicCode related to 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



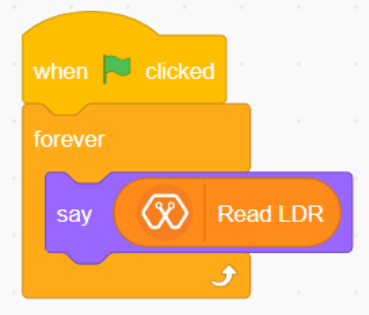
Lesson 07 - Night Light

- 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
    - M-M jumper wires
    - Cardboard
- Steps for the Activity

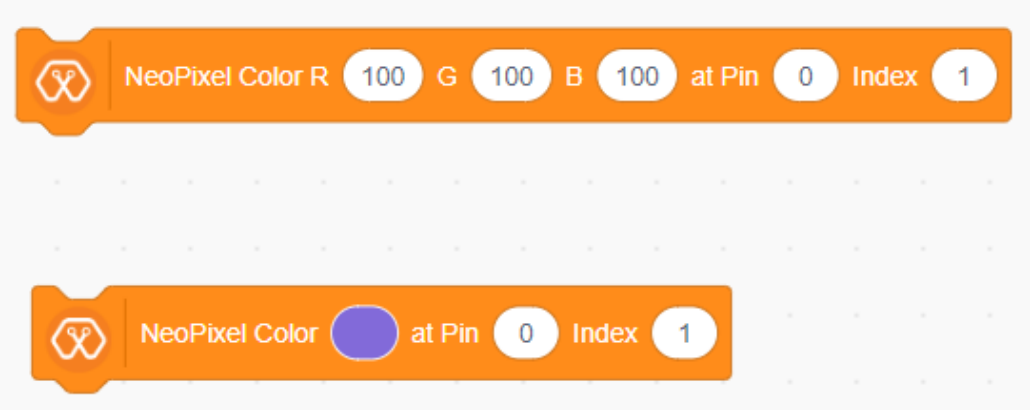
  Expected Output - https://youtu.be/g1bGuv1lukQ

    - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
    - **Step 02 -** Make a simple home structure using cardboard

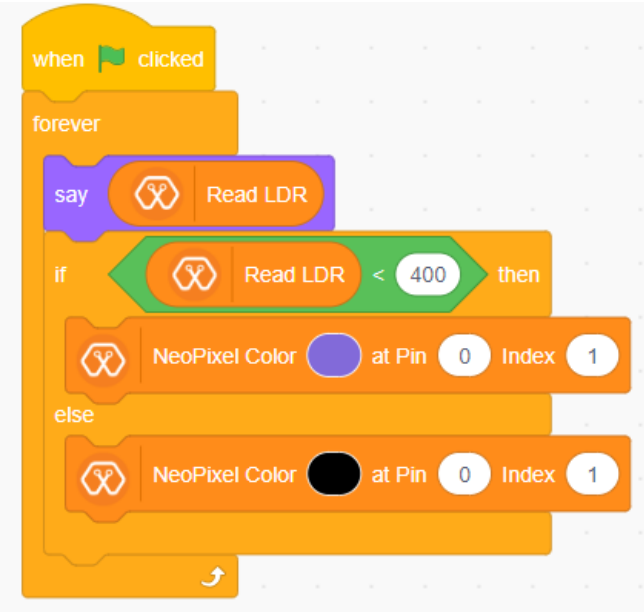
    - **Step 03 -** Put the Magicbit Tiny inside the structure and make a program to read the light condition inside the home structure



- **Step 04 -** Update the program to activate the RGB LED in the Magicbit Tiny according to the measured LDR value.
  - Explain about the RGB LED functioning
  - Blocks used in MagicCode to activate RGB LED



  - Make the program and test



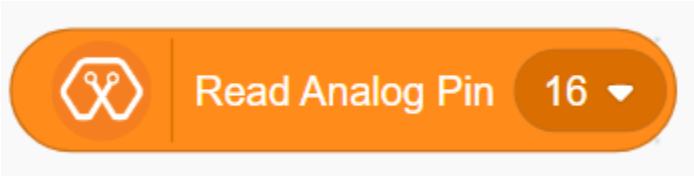
  - Adjust the program for different colors in different LDR reading ranges

Lesson 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
    - M-M jumper wires
    - Cardboard
- Steps for the Activity

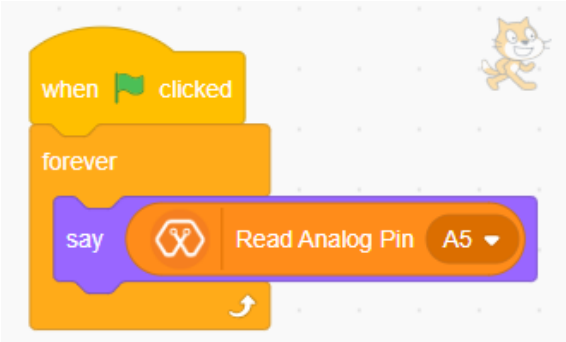
  Expected Output - https://youtu.be/NEFo_9V7h3s

    - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
    - **Step 02 -** Explain about the Proximity IR sensors
        - Function method
        - Blocks used in MagicCode for IR sensor reading



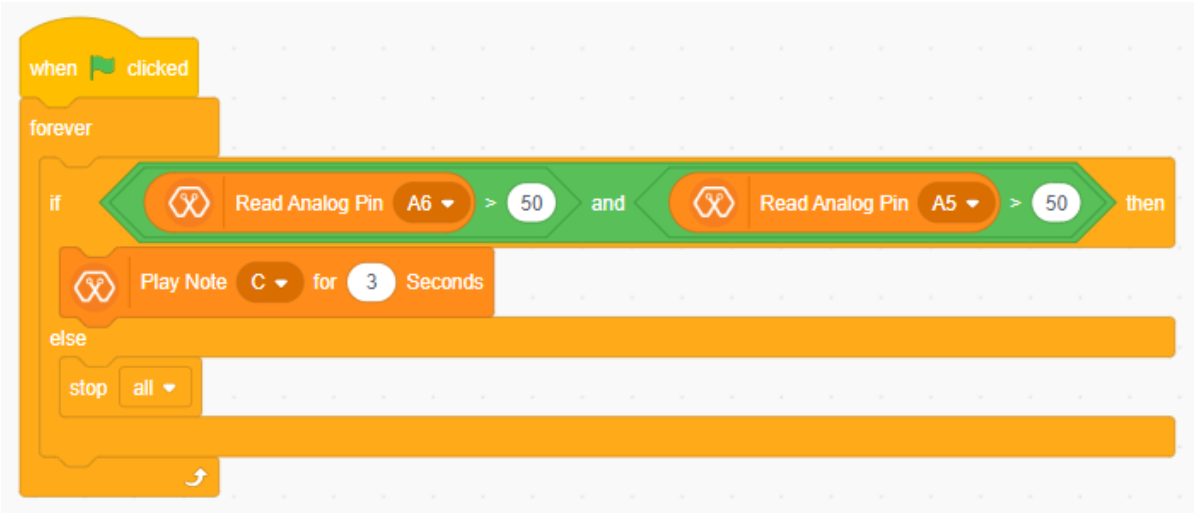
    - **Step 03 -** Make a program to get the readings from both IR sensors in the Magicbit Tiny
        - Add two sprites

- 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 explain about the “AND” and “OR” operators

  - Use AND operator and make the program



- Try - Update the program to make a fire detector
  - IR sensors for for detection
  - Change the conditions for IR readings

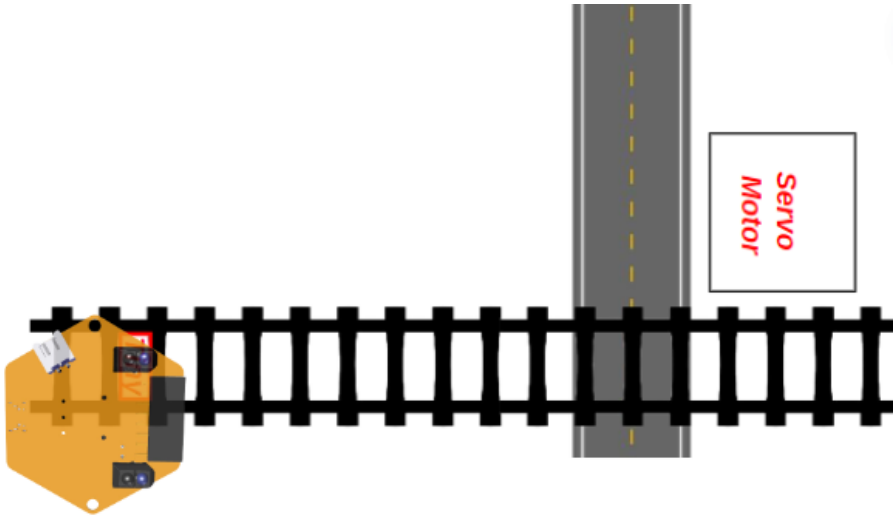
Lesson 09 - Rail Gate

- 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
    - M-M jumper wires
    - Cardboard
    - Servo motor
    - Printed Track
    - Wooden servo arm
- Steps for the Activity

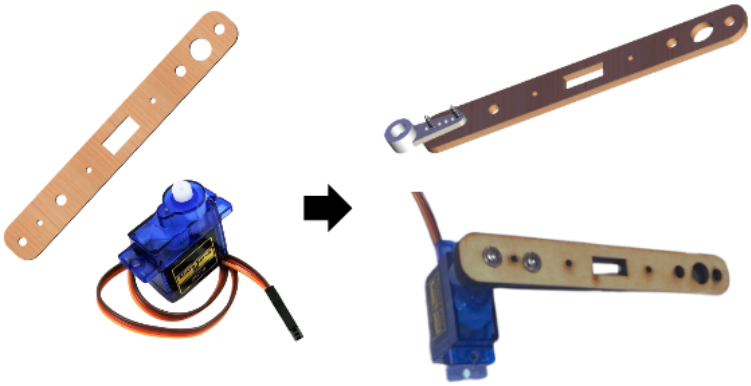
  Expected Output - https://youtu.be/gxgTAXWFNac

    - **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
    - **Step 02 -** Paste the printed track on piece of cardboard and remove the area marked as **“Tiny”**
        - Track - https://drive.google.com/file/d/1nIJiuWGOB8sNJ9kUuAU6dkNuXnkRiQ2z/view?usp=sharing

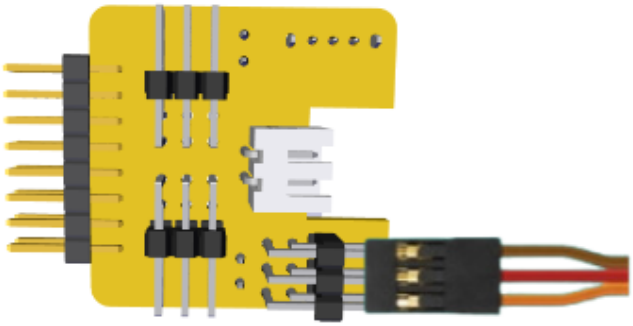
- **Step 03 -** Place magicbit tiny as below.



- **Step 04 -** Fix the wooden servo arm with the servo motor

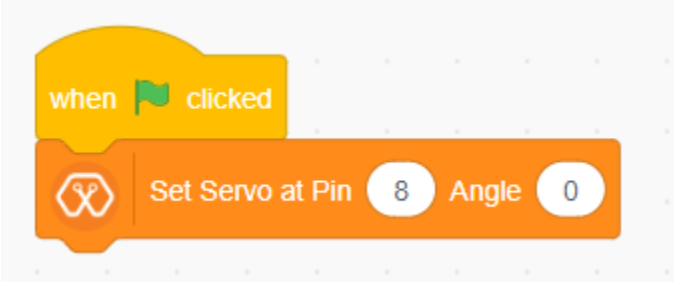


- **Step 05 -** Attach the servo motor in the marked area of the set up at a higher level .
- **Step 06 -** Connect the servo motor cable with tiny extension pin 8

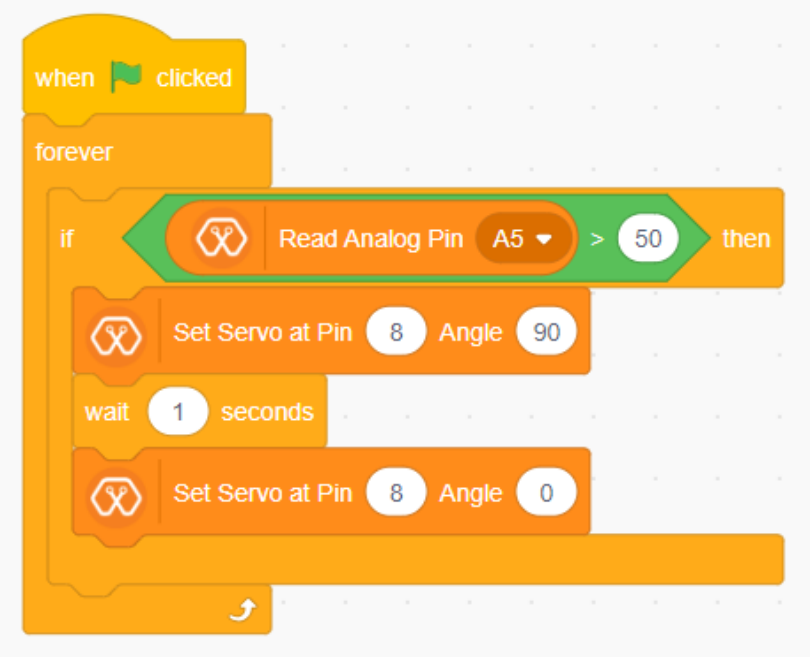


- **Step 07 -** Power the Magicbit Tiny with the battery while connected via USB

- **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.

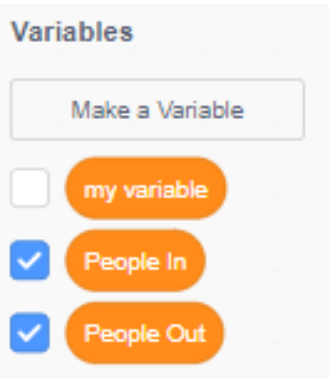


Lesson 10 - People Count

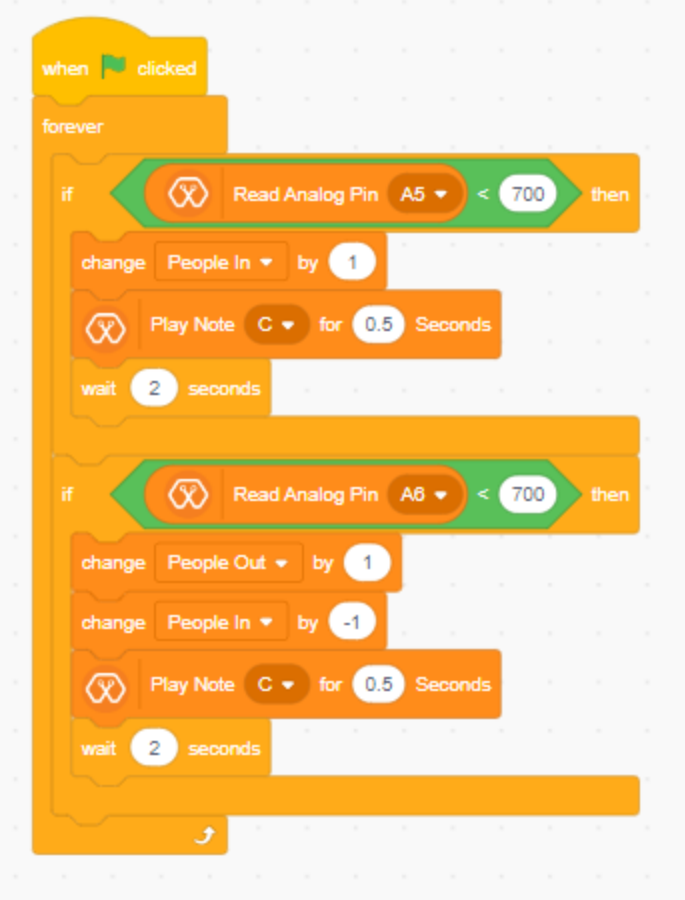
- Activity
  - Create a simple program to count the no.of people (motions) entering through a door and going out from the door when a motion is detected by the Proximity IR sensors.
- Learning Outcomes
  - Practical applications of the concepts
  - Creativity and Innovation
  - Functioning of the proximity IR sensors
  - Variables in programming
- Materials Required
  - Magicbit Tiny Board
  - USB cable
  - Computer with Internet Connection
  - MagicCode Platform
  - Cardboard
- 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 (Optional) -** Create a door / home structure using cardboard
  - **Step 03 (Optional)** - Make the scratch interface by adding a suitable backdrop and sprite
  - **Step 04 -** Explain about the "Variables" in programming
    - Create two variables as **"People In"** and **"People Out"**



- **Step 05 -** Make the program to update the created variables according to the motions from IR sensors

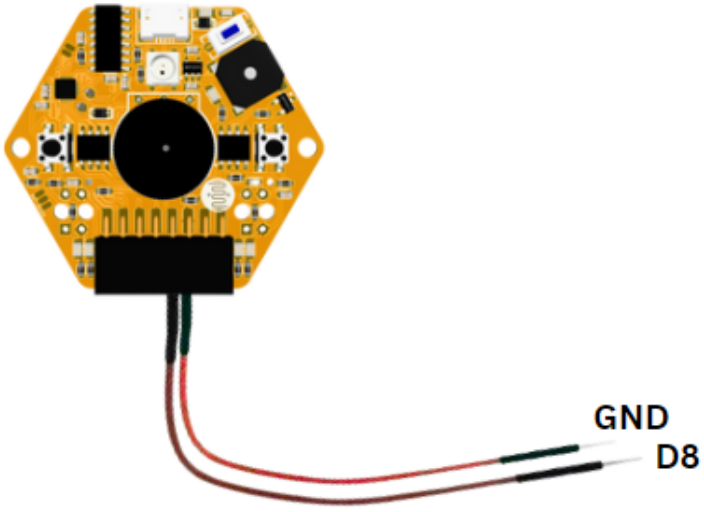


Lesson 11 - DIY Sensors

- Activity 01 - DIY Conductivity Sensor
    - Create a simple program to indicate the conductivity of different materials as a Neopixel 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

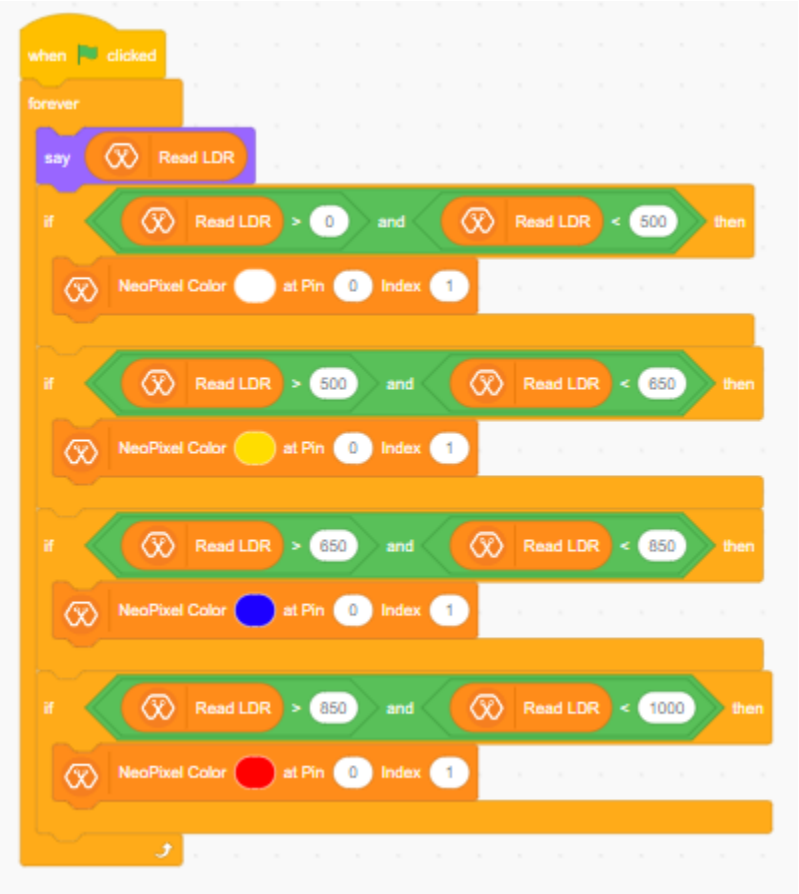
Moderate Conductivity

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 Neopixel (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 NeoPixel RGB LED using the Magicbit Tiny.
        - Step 01 - Make the below program to get the ambient light values from the LDR and according to that values , control the RGB color.



Lesson 12 - DIY Hand Dryer

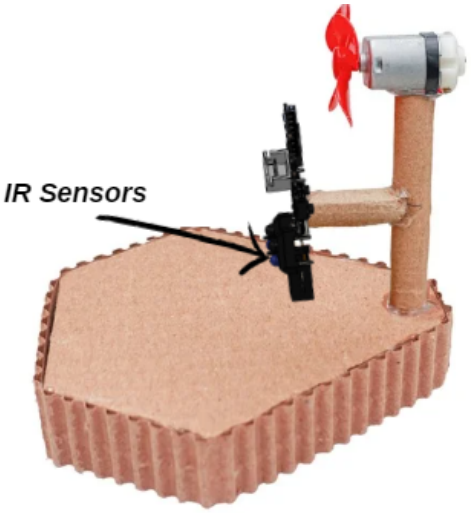
- Activity - 01
    - Create a simple program to activate the Fan connected DC motor when the hands are detected
- Learning Outcomes
    - Practical applications of the concepts
    - Creativity and Innovation
    - Functioning of DC motor
- Materials Required
    - Magicbit Tiny Board
    - USB cable
    - Computer with Internet Connection
    - MagicCode Platform
    - DC motor
    - Plastic fan blade
    - Cardboard
- Steps for the Activity

Expected Output - Please Focus on the structure making part and final Output only here. https://youtu.be/OX7ApKmwSwY?si=Co2icpvLkH3P7noq

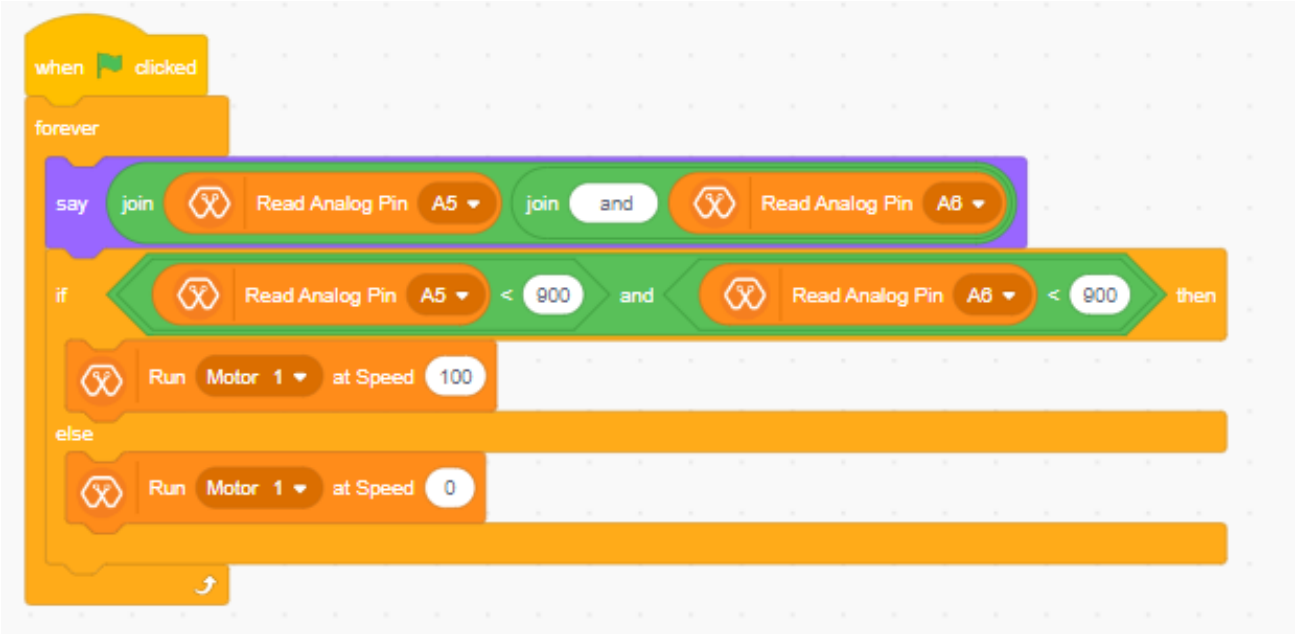
- **Step 01** - Get into the MagicCode platform → MagicCode 3.0 and connect Magicbit Tiny
- **Step 02 (optional) -** Make the below structure using cardboard

- **Step 03 -** Fix the Fan blade connected DC motor to the above structure

- **Step 04 -** Connect Magicbit Tiny board to the structure keeping the IR sensors to the front .



- **Step 05 -** Connect the DC motor cables to M1+ and M1- pins or M2+ and M2- pins in the Magicbit Tiny board.
- **Step 06 -** Power the Tiny board with batteries while connected to the computer.
- **Step 06 -** Make the program to detect the hands by IR sensors and activate the DC motor.



- Try - Try to control the speed of the motor using the potentiometer