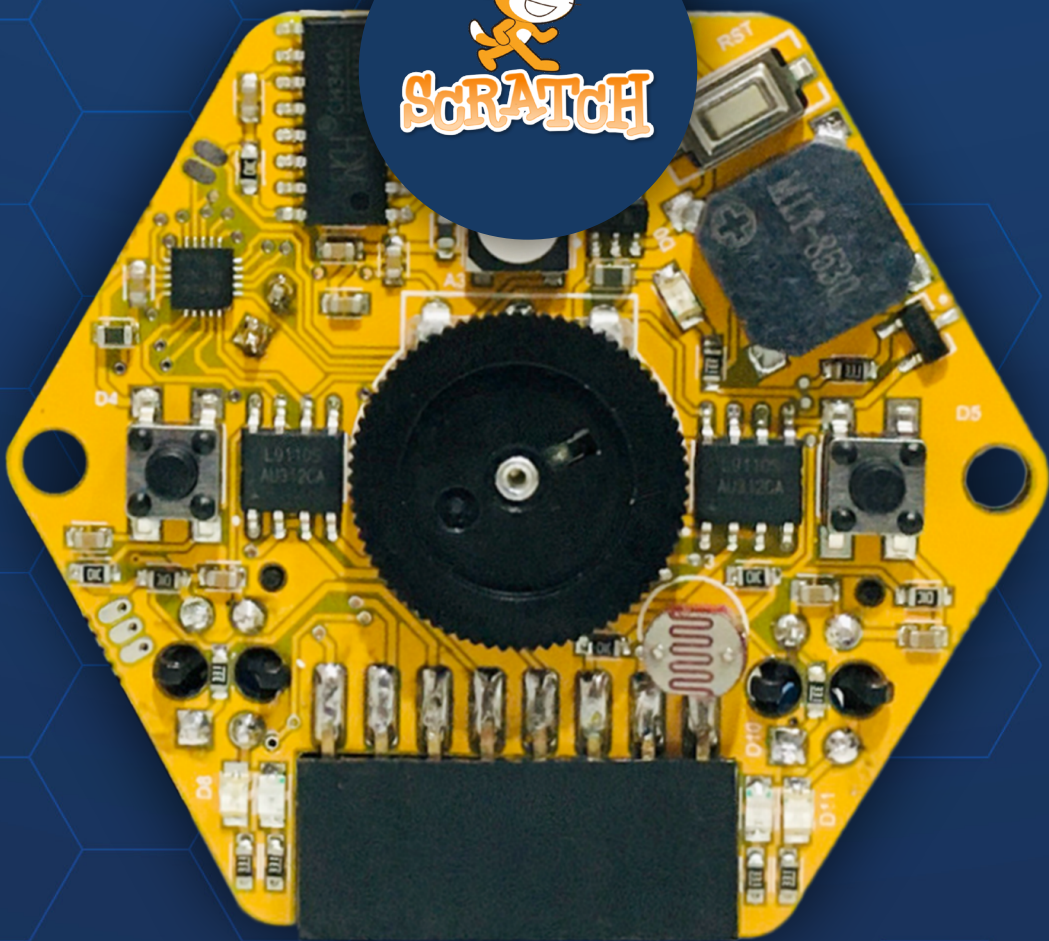


magicbit

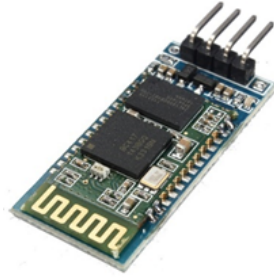
# TINY

WITH SCRATCH

ADVANCED



Continue with these lessons, you are required have a HC-06 Bluetooth Module (4 pins) or a long USB cable.



The Bluetooth module should be pre-programmed from Magicbits.

## Learning Outcomes

- o Advanced programming in Scratch
- o Magicbit Tiny associated mini robotic and automated projects
- o Creative hands-on projects using simple craft materials

## Lessons Outline

Lesson Number	Lesson Name
01	Apple collector - Animated Game
02	Bluetooth remote control car
03	Obstacle avoiding robot car
04	Line follower robot car
05	Roach Robot
06	Dancing Robot
07	Automatic water tap
08	Fire fighter

# 01. Introduction to Scratch



## ACTIVITY 01

### Animating few sprites to make a simple game

#### ◆ Learning Outcomes

- Recalling scratch programming basics - Multiple sprites, multiple scripts
- Recalling Magicbit Tiny

#### ◆ Materials Required

- Magicbit Tiny Board
- Tiny Extension board
- Battery with holder
- Computer with Internet Connection
- MagicCode Platform

#### ◆ Steps for the Activity

- Expected Output - <https://youtu.be/8orzRLldcXQ>

#### STEP 01

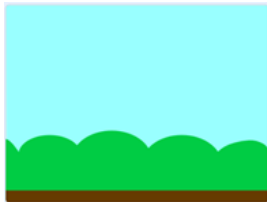
Connect the Tiny extension with the Magicbit Tiny board and then the Bluetooth module to the extension board. Then connect the battery to the battery connector in the extension board and turn ON the switch.



**STEP 02** Get into the MagicCode platform - [MagicCode 3.0](#) and connect Magicbit Tiny via Bluetooth

- o Help Guide – [Bluetooth Connection.pdf](#)

**STEP 03** Get the necessary sprites and backdrop for the game - apple collector



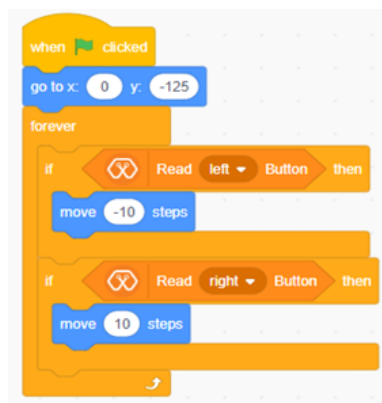
**Backdrop**



**Sprites**

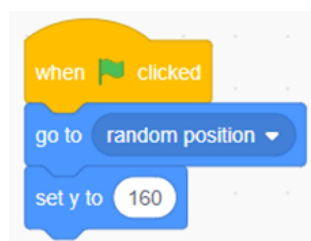
**STEP 04** Make the programs for the sprites separately.

- o For the **“Bowl”** sprite - To move it along the stage using the tiny buttons

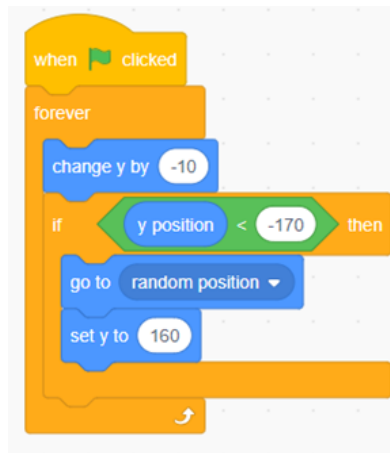


- o For the **“Apple”** sprite

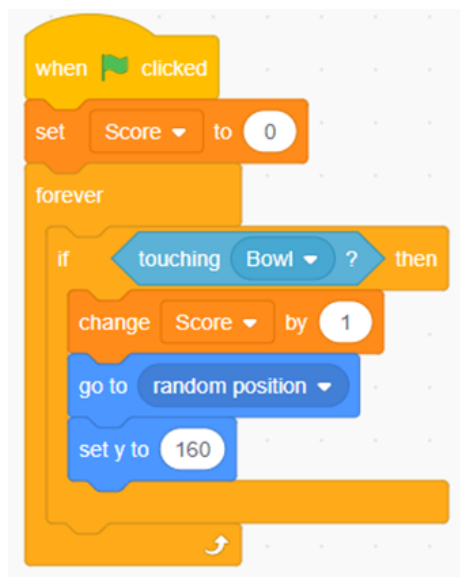
- To **start** with a random position in top of the stage



- To make the apple fall down and come back to the top if it reaches the lower edge of the stage



- To update the score when the apple touches the bowl



**STEP 05** Make the game more challenging.

## 02. Bluetooth-Remote Controlling Car



### ACTIVITY 02

Make a robot car which can control via Bluetooth

#### ✦ Learning Outcomes

- Bluetooth-Remote Controlling technique
- Robotics Basics

#### ✦ Materials Required

- Magicbit Tiny Board
- Computer with Internet Connection
- MagicCode Platform
- Wooden Robot platform
- Bluetooth Module
- Battery connector with batteries

#### ✦ Steps for the Activity

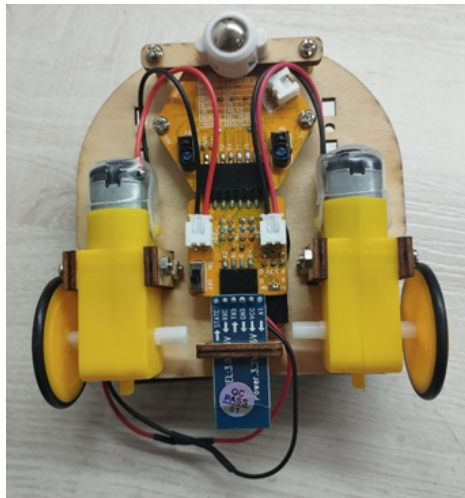
- Expected Output - [https://youtu.be/RYpIK\\_Ey0MU](https://youtu.be/RYpIK_Ey0MU)

**STEP 01** Assemble the Tiny Robot using the provided the wooden parts

- Use the below video for the robot assembling steps

Robot Assembling Guide - <https://youtu.be/2kMGVRj7NBk>

**STEP 02** Turn the switch ON in the Tiny Extension board.

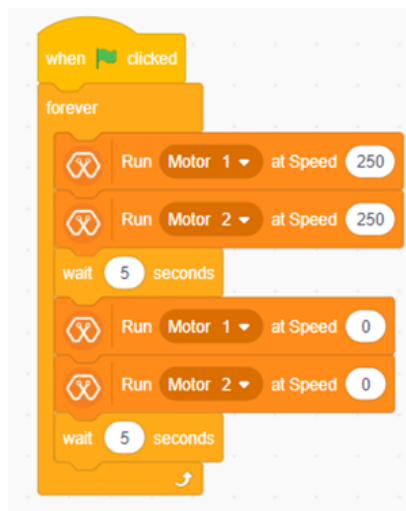


**STEP 03** Get into the MagicCode platform - [MagicCode 3.0](#) and connect Magicbit Tiny via Bluetooth

- o Help Guide – [Bluetooth Connection.pdf](#)

**STEP 04** Make a simple program to control the motors

- o Make sure to keep the speed of the motors in between 100 - 250



**STEP 05** Make a program to move the robot in all directions when the arrow keys in the keyboard are pressed.

when up arrow key pressed

Run Motor 1 at Speed 150

Run Motor 2 at Speed 150

when right arrow key pressed

Run Motor 1 at Speed 50

Run Motor 2 at Speed 150

when left arrow key pressed

Run Motor 1 at Speed 150

Run Motor 2 at Speed 50

when space key pressed

Run Motor 1 at Speed 0

Run Motor 2 at Speed 0



## 03. Obstacle Avoiding Robot Car



### ACTIVITY 03

Make a robot car which can move itself by avoiding the obstacles

#### ✦ Learning Outcomes

- Obstacle avoiding technique
- Robotics Basics

#### ✦ Materials Required

- Magicbit Tiny Board
- Tiny Extension board
- Computer with Internet Connection
- MagicCode Platform
- Wooden Robot platform
- Bluetooth Module
- Battery connector with batteries

#### ✦ Steps for the Activity : Use the same robot assembled in Lesson 02

- Expected Output - <https://youtu.be/LPN8Rmhk8iM>

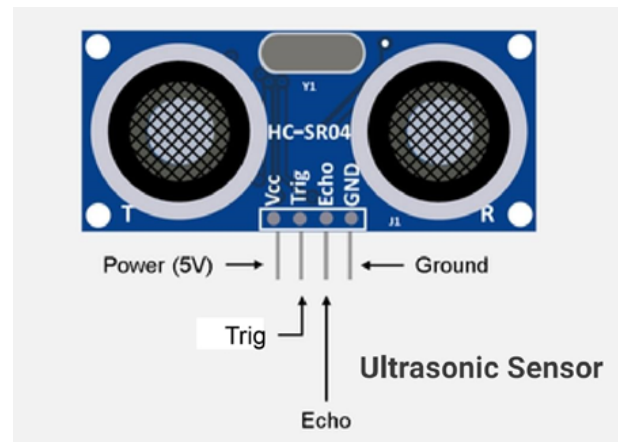
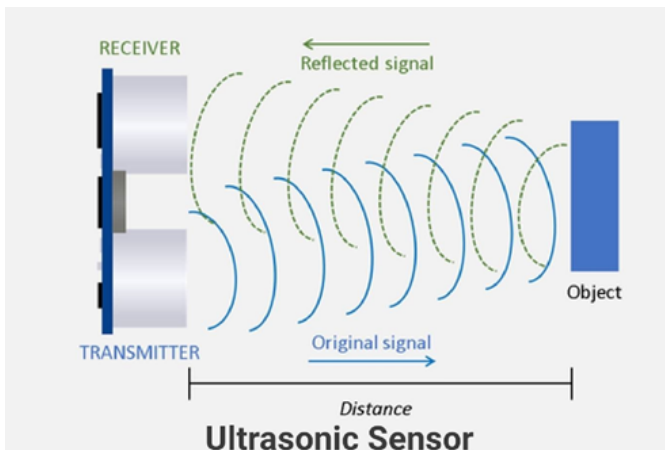
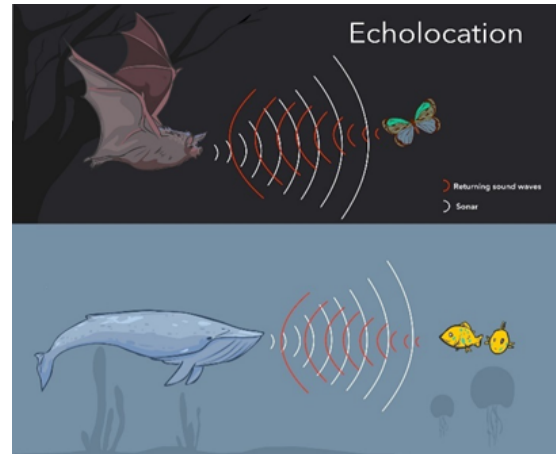
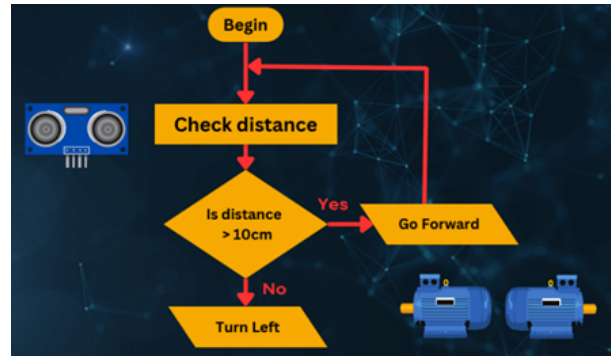
#### STEP 01

Get into the MagicCode platform - [MagicCode 3.0](#) and connect Magicbit Tiny via Bluetooth

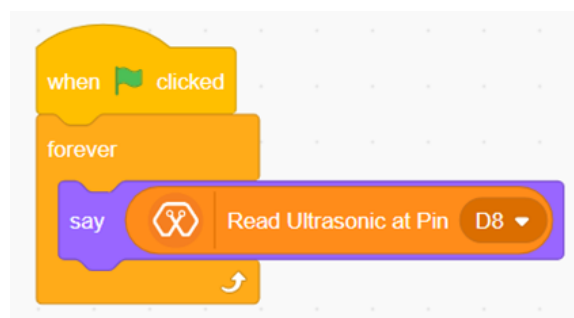
- Help Guide – [Bluetooth Connection.pdf](#)

#### STEP 02

Understand the concept of avoiding obstacles

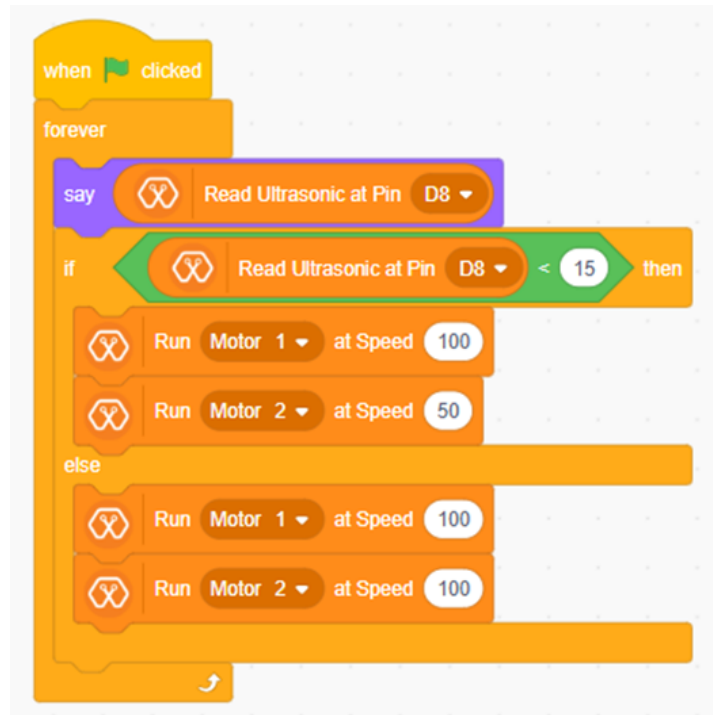


**STEP 03** Make the program to get the distance measured by the ultrasonic sensor and display it on the stage.



**STEP 04**

Make the program to make the robot to avoid the obstacles and move



```
when clicked
  forever
    say Read Ultrasonic at Pin D8
    if Read Ultrasonic at Pin D8 < 15 then
      Run Motor 1 at Speed 100
      Run Motor 2 at Speed 50
    else
      Run Motor 1 at Speed 100
      Run Motor 2 at Speed 100
```

The image shows a Scratch script for a robot's obstacle avoidance. It starts with a 'when clicked' event block. A 'forever' loop contains the following blocks: a 'say' block with the text 'Read Ultrasonic at Pin D8', an 'if' block with the condition 'Read Ultrasonic at Pin D8 < 15', and two 'Run Motor' blocks. The 'if' block has two paths: a 'then' path with 'Run Motor 1 at Speed 100' and 'Run Motor 2 at Speed 50', and an 'else' path with 'Run Motor 1 at Speed 100' and 'Run Motor 2 at Speed 100'.

## 04. Line Following Robot Car



### ACTIVITY 04

Make a robot car which can move along a black line on a white surface following the line.

#### ✦ Learning Outcomes

- Obstacle avoiding technique
- Robotics Basics

#### ✦ Materials Required

- Magicbit Tiny Board
- Tiny extension board
- Computer with Internet Connection
- MagicCode Platform
- Wooden Robot platform
- Bluetooth Module
- Black track / line
- Battery connector with batteries

#### ✦ Steps for the Activity : Use the same robot assembled above

- Expected Output - <https://youtu.be/nZds7kcdqco>

#### STEP 01

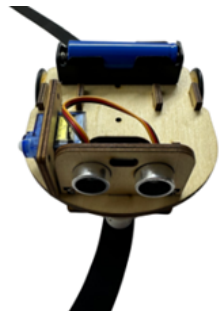
Get into the MagicCode platform - [MagicCode 3.0](#) and connect Magicbit Tiny via Bluetooth

- Help Guide – [Bluetooth Connection.pdf](#)

#### STEP 02

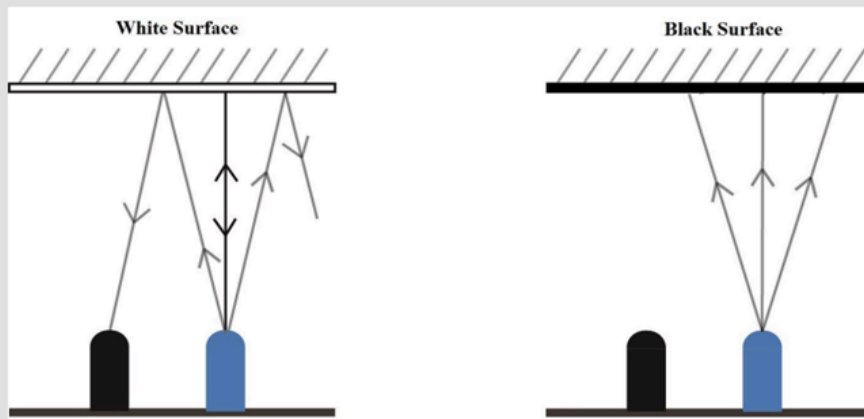
Understand the concept used to follow the line.

- Industrial usage of line follower robots - [https://www.youtube.com/watch?v=peOM\\_Nk4AEY](https://www.youtube.com/watch?v=peOM_Nk4AEY)

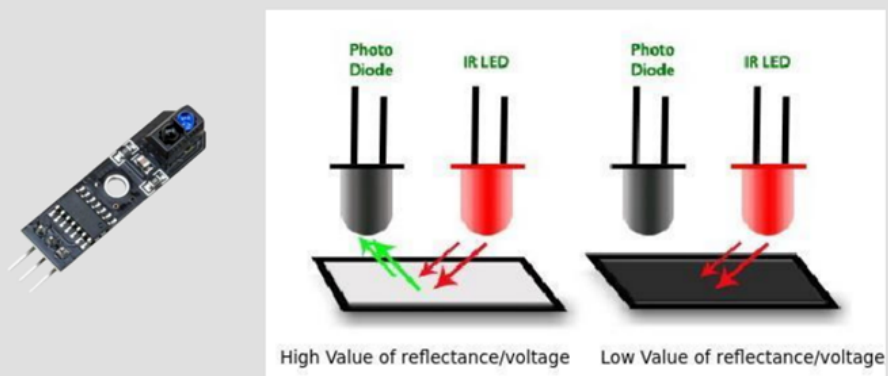


Line Following Robot

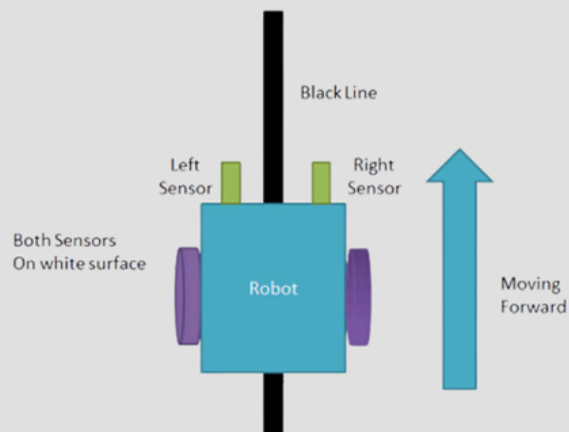
## Black and White Identification



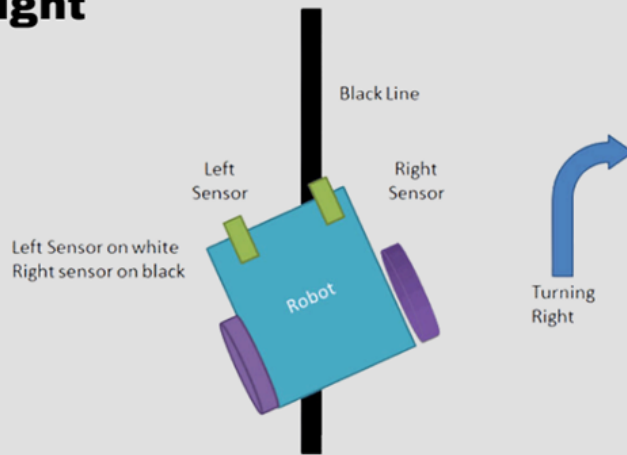
## IR Proximity / Line Tracking Sensor



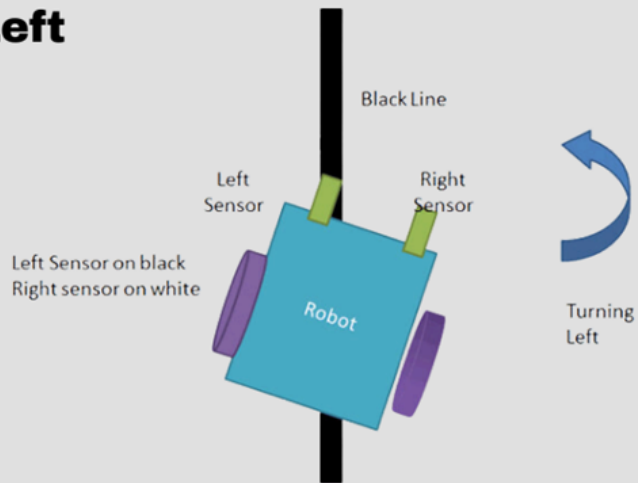
## Forward Motion



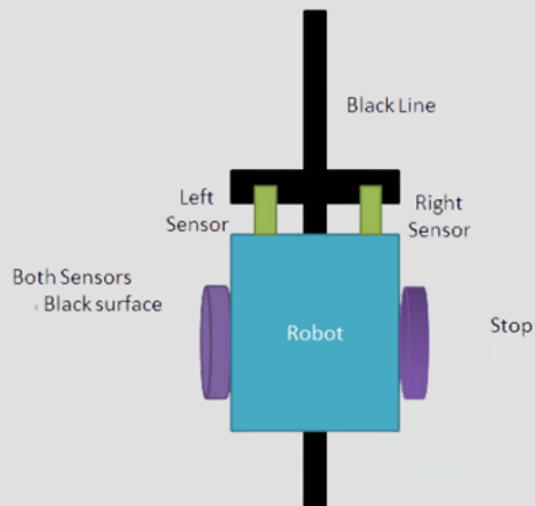
## Turning Right



## Turning Left



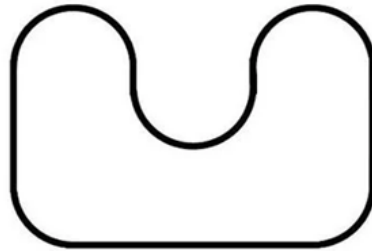
## Stop



**STEP 03** Make a black track / line on a white surface to test the robot

- o Printable Black Track: <https://drive.google.com/file/d/1yxoFkhBaeNoNTSKU1nsgiqaljrb9Af0w/view?usp=sharing>

Impotent: This document is scaled to A2 size.

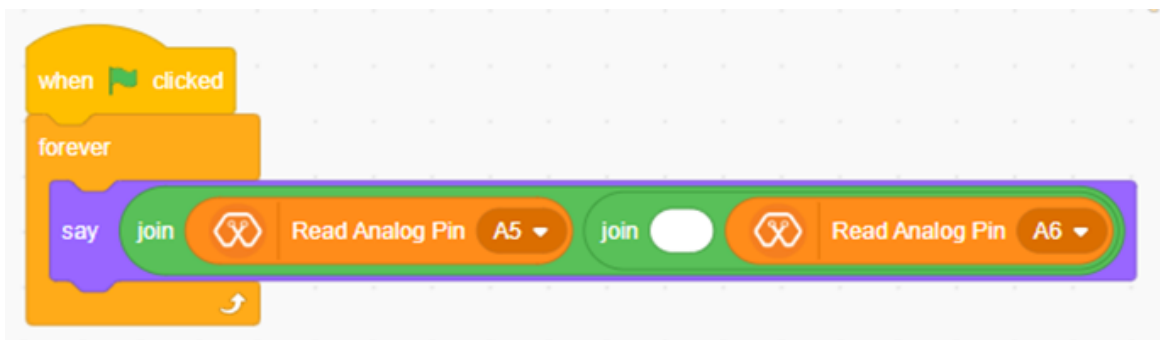


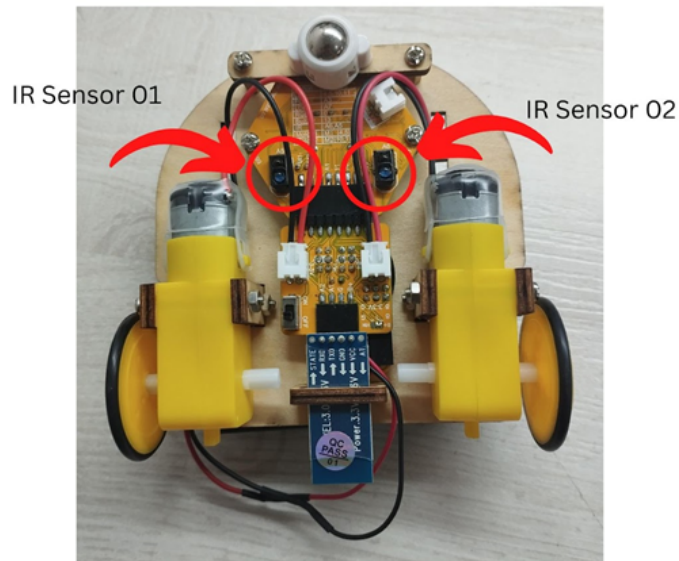
- o If you use your own black track, make sure the thickness of the black track is **less than 2 cm**.



**STEP 03** Make the program to check the readings of IR sensors in black and white surfaces.

- o Make the code below
- o Keep the IR sensors on black and white surfaces and identify the values for both colors.



**STEP 05**

Make the program to follow the line by checking for the below conditions according to the IR sensor readings.

- If both sensors detect white - move forward
- If left sensor detects white and right sensor detects black - turn right
- If left sensor detects black and right sensor detects white - turn left
- If both sensors detect black - Stop motion

**Note:** The values used in below code may vary according to the light level in your background. Adjust the given values according to your readings from the IR sensors and try the program.



```
when clicked
  forever
    say join [Read Analog Pin A5 < 150] and [Read Analog Pin A6 < 450]
    if [Read Analog Pin A5 < 150] and [Read Analog Pin A6 < 450] then
      Run Motor 1 at Speed 100
      Run Motor 2 at Speed 100
    if [Read Analog Pin A5 < 150] and [Read Analog Pin A6 > 450] then
      Run Motor 1 at Speed 100
      Run Motor 2 at Speed 50
    if [Read Analog Pin A5 > 150] and [Read Analog Pin A6 < 450] then
      Run Motor 1 at Speed 50
      Run Motor 2 at Speed 100
    if [Read Analog Pin A5 > 150] and [Read Analog Pin A6 > 450] then
      Run Motor 1 at Speed 0
      Run Motor 2 at Speed 0
```

## 05. Roach Robot



### ACTIVITY 05

Develop a mechanism to control the robot according the environmental light condition - Cockroach concept

#### ✦ Learning Outcomes

- Practical application of the concepts

#### ✦ Materials Required

- Magicbit Tiny Board
- Tiny Extension board
- Computer with Internet Connection
- MagicCode Platform
- Wooden Robot platform
- Bluetooth Module

#### ✦ Steps for the Activity

- Expected Output - <https://youtu.be/hP4Kq4Hnfe0>

#### STEP 01

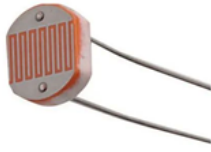
Assemble the robot as guided below (same robot used in activities )

- Robot Assembling video - <https://youtu.be/2kMGVRj7NBk>

#### STEP 02

Get into the MagicCode platform - [MagicCode 3.0](#) and connect Magicbit Tiny via Bluetooth

- Help Guide – [Bluetooth Connection.pdf](#)
- 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.



**STEP 03** Make the program to get the light intensity readings in your environment

```
when clicked clicked
forever
say Read LDR
```

**STEP 04** Make the final program

```
when clicked clicked
forever
say Read LDR
if Read LDR > 500 then
  Run Motor 1 at Speed 150
  Run Motor 2 at Speed 50
else
  Run Motor 1 at Speed 150
  Run Motor 2 at Speed 150
```

## 06. Dancing Robot



### ACTIVITY 06

Develop a mechanism to control the robot as it looks like dancing while generating different light patterns via Neo-pixel LED and some musical tones via the buzzer.

#### ✦ Learning Outcomes

- Practical application of the concepts

#### ✦ Materials Required

- Magicbit Tiny Board
- Computer with Internet Connection
- MagicCode Platform
- Wooden Robot platform
- Bluetooth Module

#### ✦ Steps for the Activity

- Expected Output - [https://youtu.be/1p1UN6Dc\\_14](https://youtu.be/1p1UN6Dc_14)

**STEP 01** Assemble the robot as guided below (same robot used in activities )

- Robot Assembling video - <https://youtu.be/2kMGVRj7NBk>

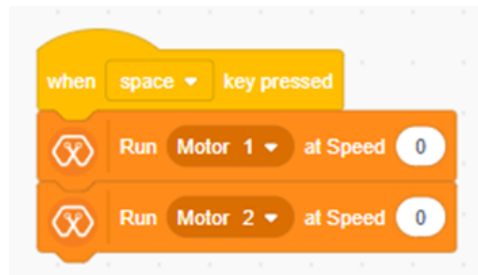
**STEP 02** Flow of the program

- Make the robot to stop the motion when the space key is pressed.
- Make the buzzer to generate tones when any letter (eg:-M) is pressed
- Make the robot to move in different directions while making different color lights in Neo-pixel LED.

**STEP 03** Get into the MagicCode platform - [MagicCode 3.0](#) and connect Magicbit Tiny via **Bluetooth Mode**

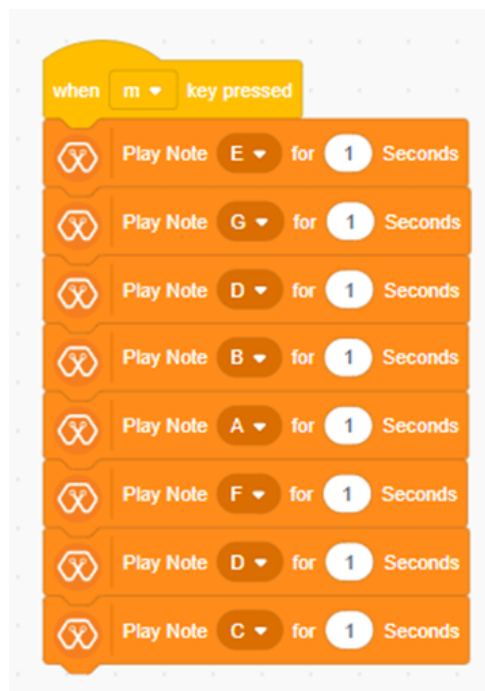
- o Help Guide – [Bluetooth Connection.pdf](#)

**STEP 04** Make the code to stop the robot's motion when the space key is pressed



**STEP 05** Make the code to hear the tones through the buzzer when any letter (eg:-M) is pressed.

- o Make any tone but don't change the time below 1 second



**STEP 06** Make the code to move the robot in different directions while making different color lights in Neo-pixel LED.

You can make this code to run in a loop by keeping all these blocks in a "forever" block.

```
when clicked
  Run Motor 1 at Speed 100
  Run Motor 2 at Speed 0
  NeoPixel Color green at Pin 0 Index 1
  wait 1 seconds
  NeoPixel Color purple at Pin 0 Index 1
  wait 1 seconds
  NeoPixel Color red at Pin 0 Index 1
  wait 1 seconds
  Run Motor 1 at Speed 0
  Run Motor 2 at Speed 100
  NeoPixel Color yellow at Pin 0 Index 1
  wait 1 seconds
```

```
NeoPixel Color blue at Pin 0 Index 1
wait 1 seconds
NeoPixel Color magenta at Pin 0 Index 1
wait 1 seconds
Run Motor 1 at Speed 100
Run Motor 2 at Speed 100
NeoPixel Color orange at Pin 0 Index 1
wait 0.5 seconds
NeoPixel Color green at Pin 0 Index 1
wait 0.5 seconds
Run Motor 1 at Speed -100
Run Motor 2 at Speed -100
NeoPixel Color yellow at Pin 0 Index 1
wait 0.2 seconds
NeoPixel Color green at Pin 0 Index 1
wait 0.2 seconds
```

## 07. Automatic Water Tap



### ACTIVITY 07

Develop a system that functions as a water tap which operates automatically.

#### ✦ Learning Outcomes

- Practical application of the concepts
- Servo motor operation
- IR proximity sensor readings

#### ✦ Materials Required

- Magicbit Tiny Board
- Computer with Internet Connection
- MagicCode Platform
- Wooden Servo setup
- Bluetooth Module
- Rubber tube
- Plastic bottle / small container
- Empty container to collect water
- Servo Motor
- Battery connector with batteries

#### ✦ Steps for the Activity

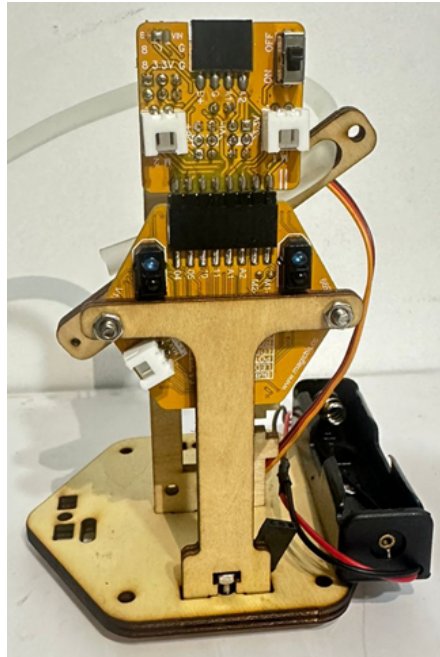
- Expected Output - <https://youtu.be/aVyoYc11diQ>

#### STEP 01

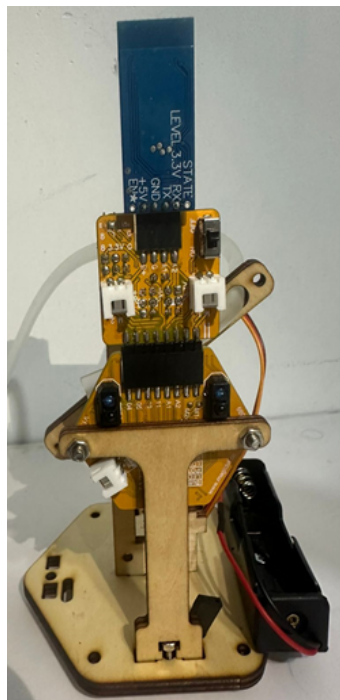
Create the set-up as in the given assembly guide.

- Set-up Assembly guide - <https://youtu.be/WQjZGKnaChQ>

**Important:** Fix the Magicbit tiny in an up-side-down way and the tiny extension accordingly.



**STEP 02** Connect the Bluetooth module to the Tiny extension as below.



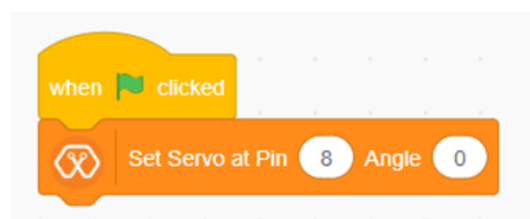


### STEP 03 Understand the flow of the program

- Given rubber tube / saline tube is taking the water out from the water container (Can use a plastic water bottle as the container).
- One end of the rubber tube is inserted to the water container and the other end is taken through the wooden arm connected to the servo motor.
- Servo motor is operated into two different angles which makes the rubber tube to fold while stopping the water flow and to continue the water flow.
- This will happen according to the presence of hands.
- Presence of hands are detected using the Proximity IR sensors in the Magicbit Tiny board.
- When the hands are detected, the servo motor should rotate into the water flowing angle and when the hands are removed (not detected) servo should rotate back to the water flow stopping angle.

### STEP 04 Measure the necessary servo angles.

- For water pouring / outgoing position
- For stopping the water flow



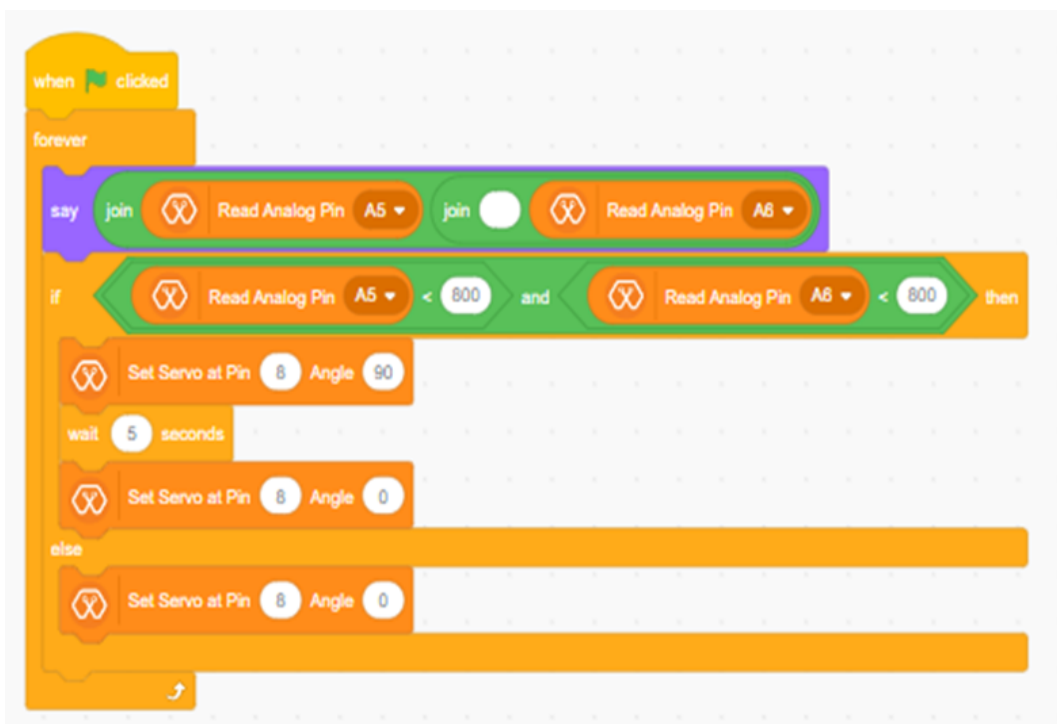
- Change the value at "Angle" different values in the range 0 -180 and get the necessary angles for above.

**STEP 05** Get the readings from two IR proximity sensors and decide the threshold value to detect the presence of hands.



```
when clicked
  forever
    say join Read Analog Pin A5 join Read Analog Pin A6
```

**STEP 06** Make the final program to operate the servo into necessary angles according to the readings from the IR sensors.



```
when clicked
  forever
    say join Read Analog Pin A5 join Read Analog Pin A6
    if Read Analog Pin A5 < 800 and Read Analog Pin A6 < 800 then
      Set Servo at Pin 8 Angle 90
      wait 5 seconds
      Set Servo at Pin 8 Angle 0
    else
      Set Servo at Pin 8 Angle 0
```

## 08. Fire Fighter Robot

**Note:** To continue this lesson, few external components are required which are not included in the Magicbit Tiny Kit



### ACTIVITY 08

**Develop a program to activate the fan connected DC motor as fire extinguisher when a fire is detected using the IR proximity sensors.**

#### ✦ Learning Outcomes

- Practical application of the concepts

#### ✦ Materials Required

- Magicbit Tiny Board
- Computer with Internet Connection
- MagicCode Platform
- Wooden platform
- Bluetooth Module
- DC motor – **Get externally**
- Plastic fan blade - **Get externally**

#### ✦ Steps for the Activity

- Expected Output - [https://youtu.be/UQOP2HUw\\_5A](https://youtu.be/UQOP2HUw_5A)

**STEP 01** Make the set up as in the above video.

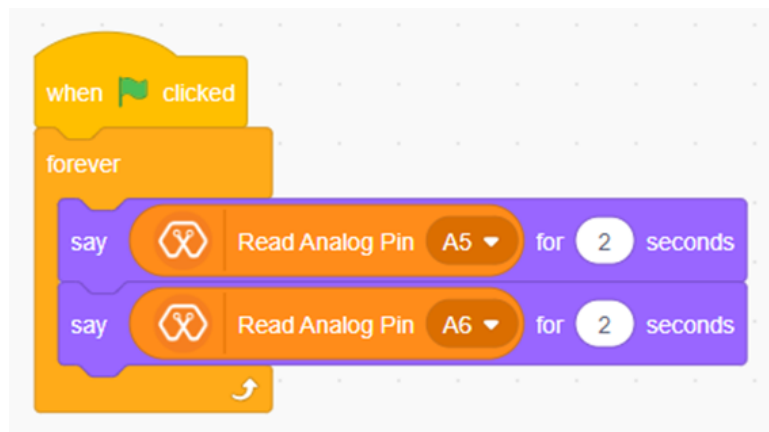
**STEP 02** Connect the Set up MagicCode via Bluetooth.

**STEP 03** Understand the mechanism used

- Detects the fire / flame via Proximity IR sensors
- Use a candle / lighter as the fire
- When the fire is detected, the DC will automatically start to rotate.

- o As a result the plastic fan blade connected to the DC motor will rotate to extinguish the fire.
- o When the fire get extinguished, the DC motor will automatically stop rotating.

**STEP 04** Make the program to get the readings of the IR sensors when the fire is detected.



**STEP 05** Make the final program to operate the DC motor when the fire is detected.

