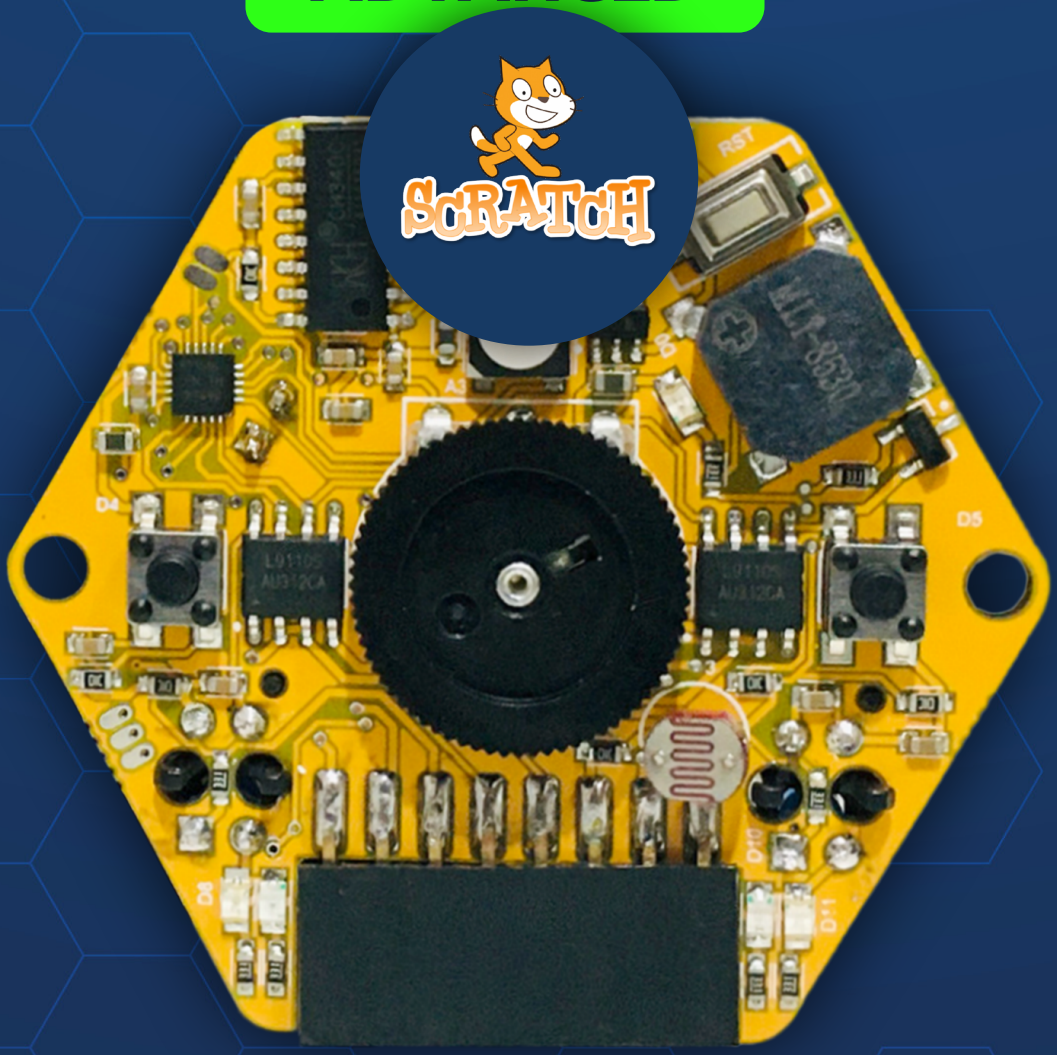
magicbit

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

- Advanced programming in Scratch
- Magicbit Tiny associated mini robotic and automated projects
- 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

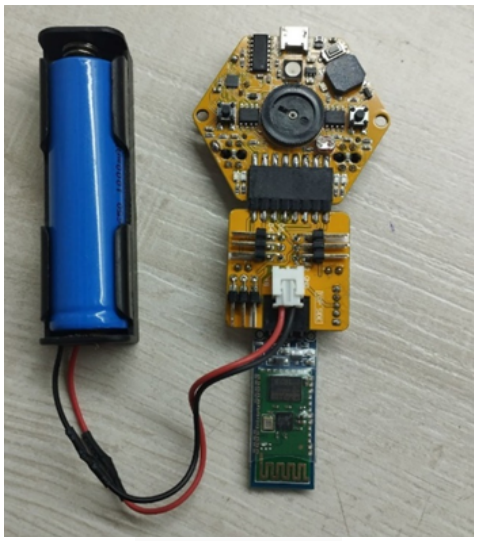
Materials Required

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

Steps for the Activity

- Expected Output - https://youtu.be/8orzRLIdcXQ

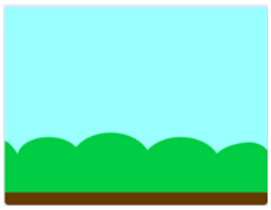
STEP 01 Connect the Tiny extension with the Magicbit Tiny board and then the Bluetooth module to the extension board. Then connect the battery to the battery connector in the extension board and turn ON the switch.



STEP 02 Get into the MagicCode platform - MagicCode 3.0 and connect Magicbit Tiny via Bluetooth

- Help Guide – Bluetooth Connection.pdf

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

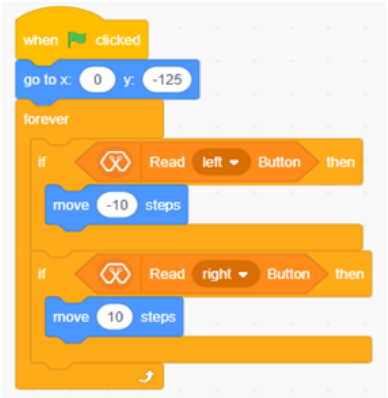


Backdrop

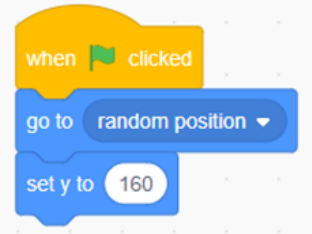
Sprites

STEP 04 Make the programs for the sprites separately.

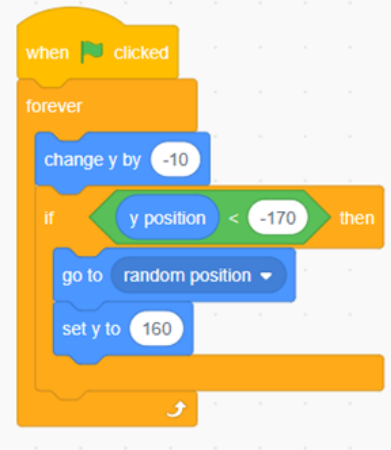
- For the **"Bowl"** sprite - To move it along the stage using the tiny buttons



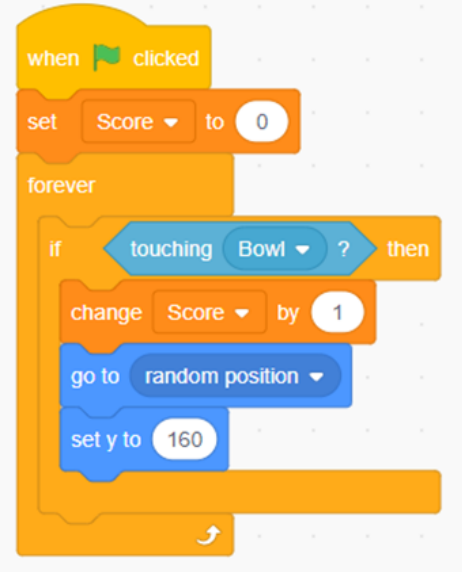
- For the **"Apple"** sprite
  - To **start** with a random position in top of the stage



- 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

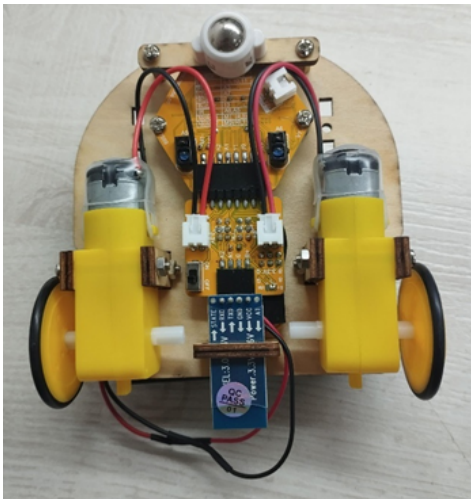
- Expected Output - https://youtu.be/RYpIK_Ey0MU

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.

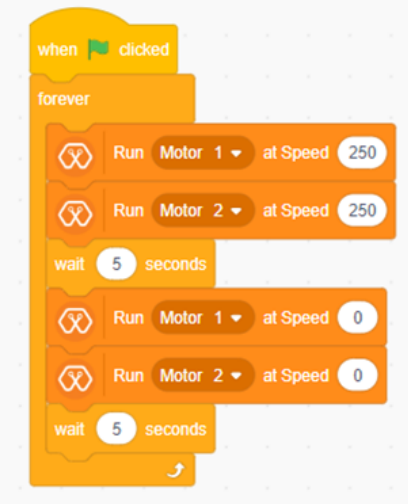


STEP 03 Get into the MagicCode platform - MagicCode 3.0 and connect Magicbit Tiny via Bluetooth

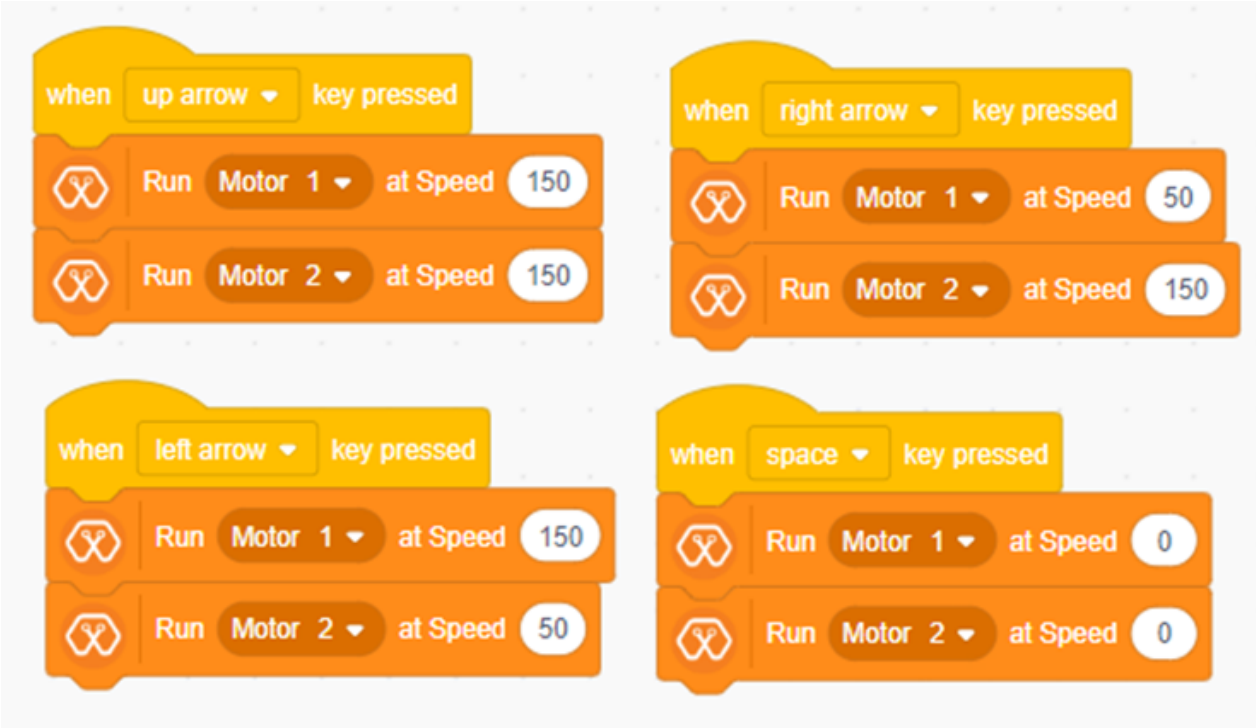
- Help Guide – Bluetooth Connection.pdf

STEP 04 Make a simple program to control the motors

- 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

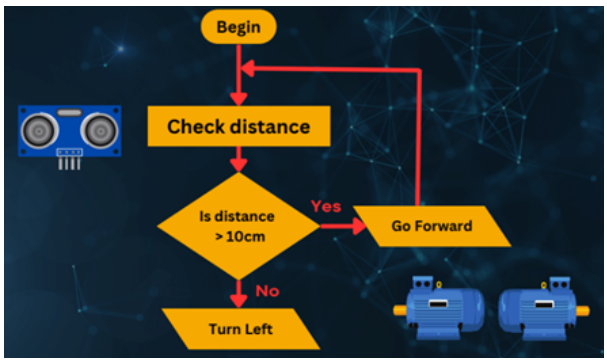
Steps for the Activity : Use the same robot assembled in Lesson 02

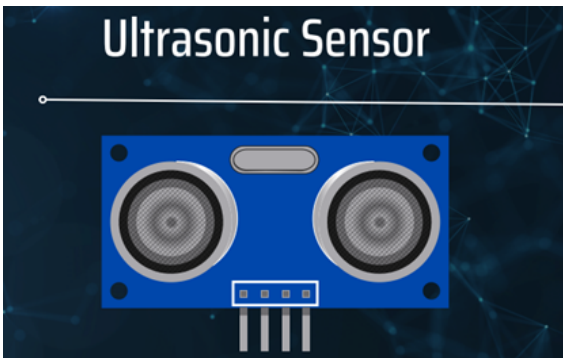
- Expected Output - https://youtu.be/LPN8Rmhk8iM

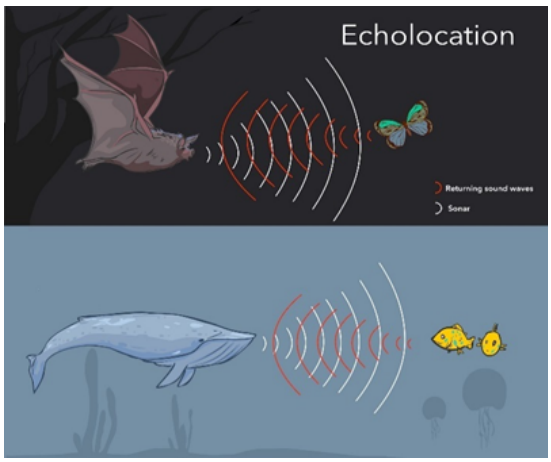
STEP 01 Get into the MagicCode platform - MagicCode 3.0 and connect Magicbit Tiny via Bluetooth

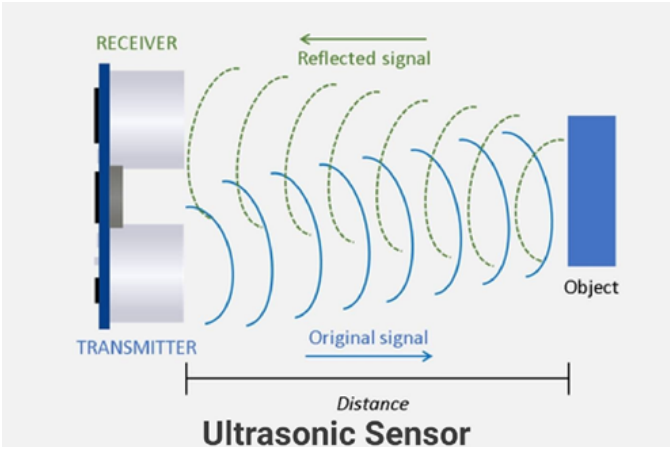
- Help Guide – Bluetooth Connection.pdf

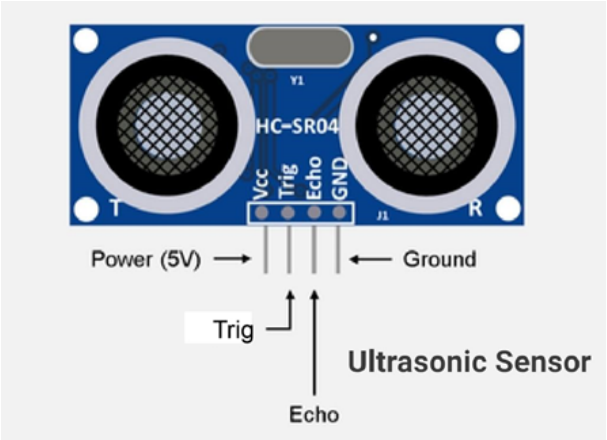
STEP 02 Understand the concept of avoiding obstacles



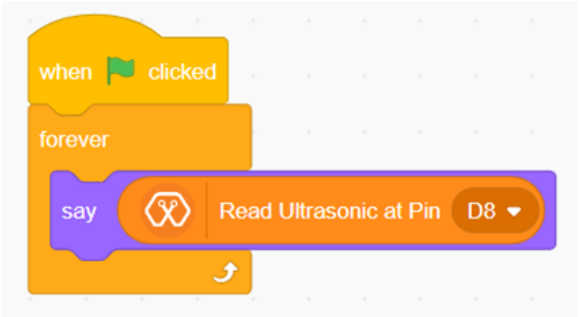








STEP 03 Make the program to get the distance measured by the ultrasonic sensor and display it on the stage.



STEP 04 Make the program to make the robot to avoid the obstacles and move

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

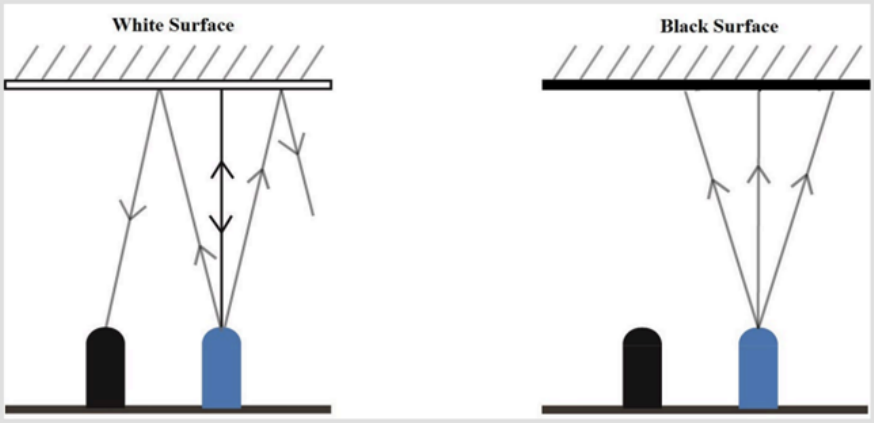
- Help Guide – Bluetooth Connection.pdf

STEP 02 Understand the concept used to follow the line.

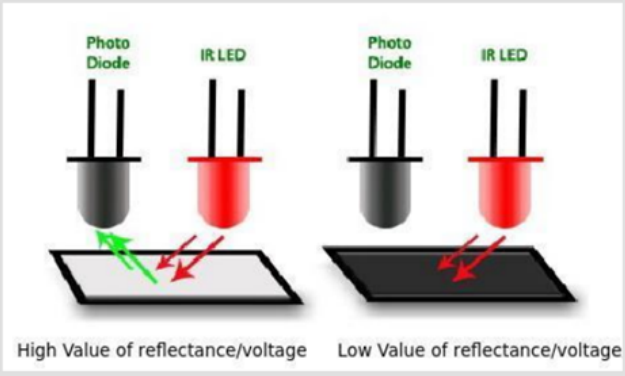
- Industrial usage of line follower robots - https://www.youtube.com/watch?v=peOM_Nk4AEY

Line Following Robot

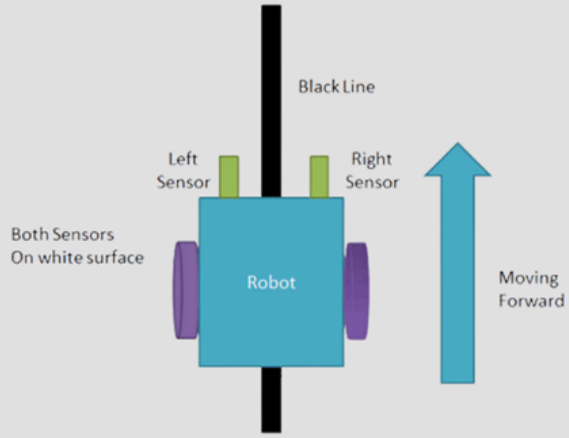
Black and White Identification

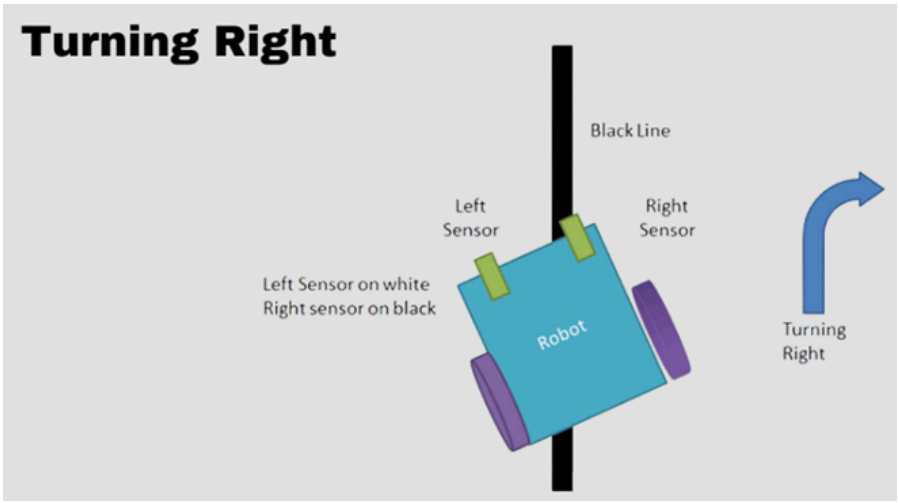


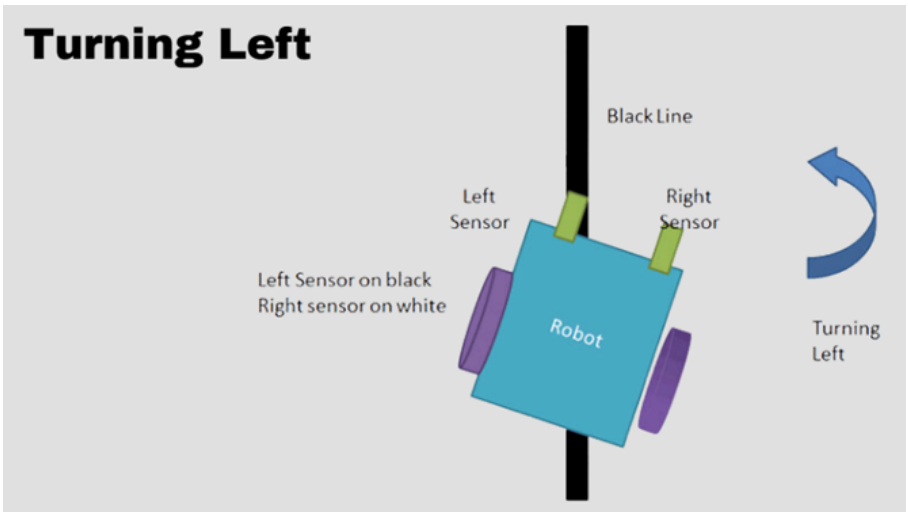
IR Proximity / Line Tracking Sensor

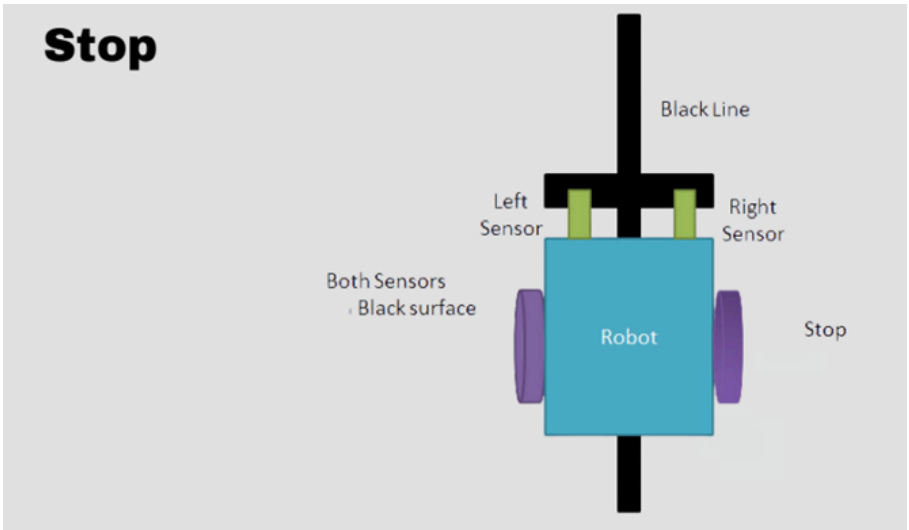


Forward Motion




Turning Right
Black Line
Left Sensor
Right Sensor
Left Sensor on white
Right sensor on black
Robot
Turning Right

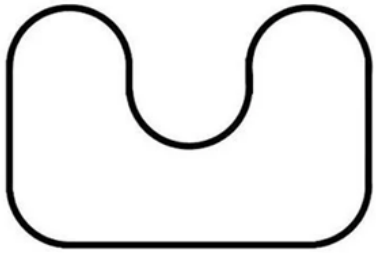

Turning Left
Black Line
Left Sensor
Right Sensor
Left Sensor on black
Right sensor on white
Robot
Turning Left


Stop
Black Line
Left Sensor
Right Sensor
Both Sensors
Black surface
Robot
Stop

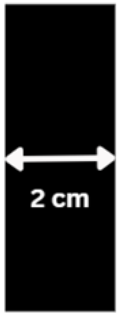
STEP 03 Make a black track / line on a white surface to test the robot

- Printable Black Track: https://drive.google.com/file/d/1hNrdazskvo0TiJwfUG0tOLLoG9YEOq5S/view?usp=sharing

Impotent: This document is scaled to A2 size.

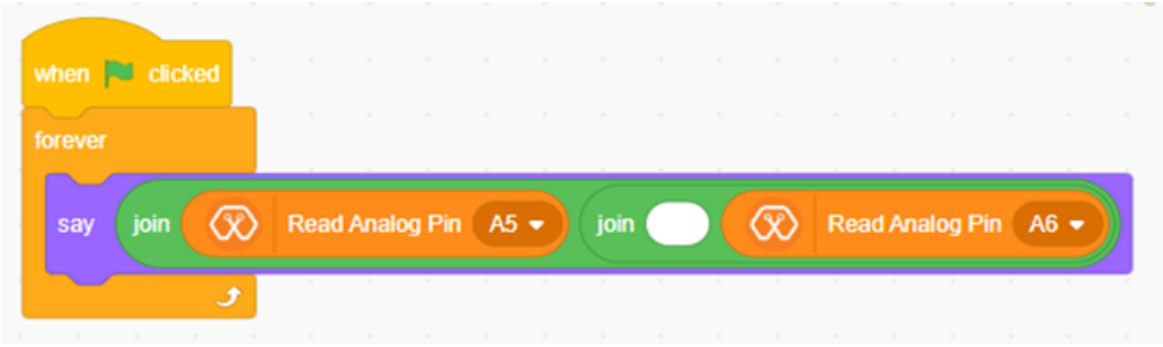


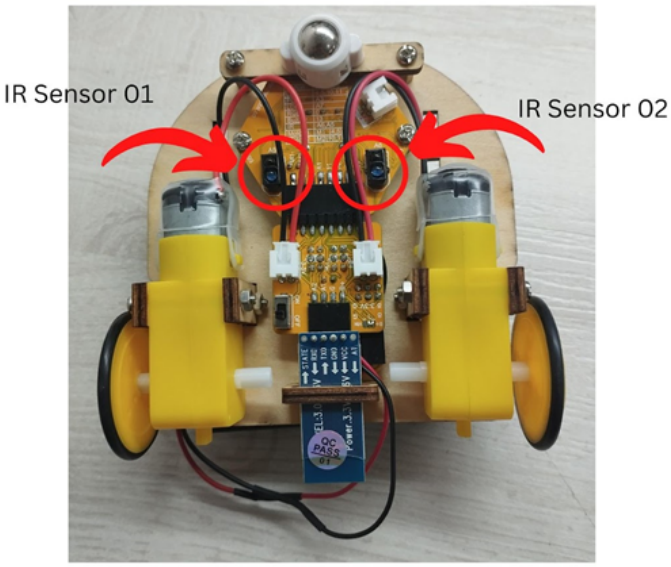
- If you use your own black track, make sure the thickness of the black track is **less than 2 cm.**



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

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

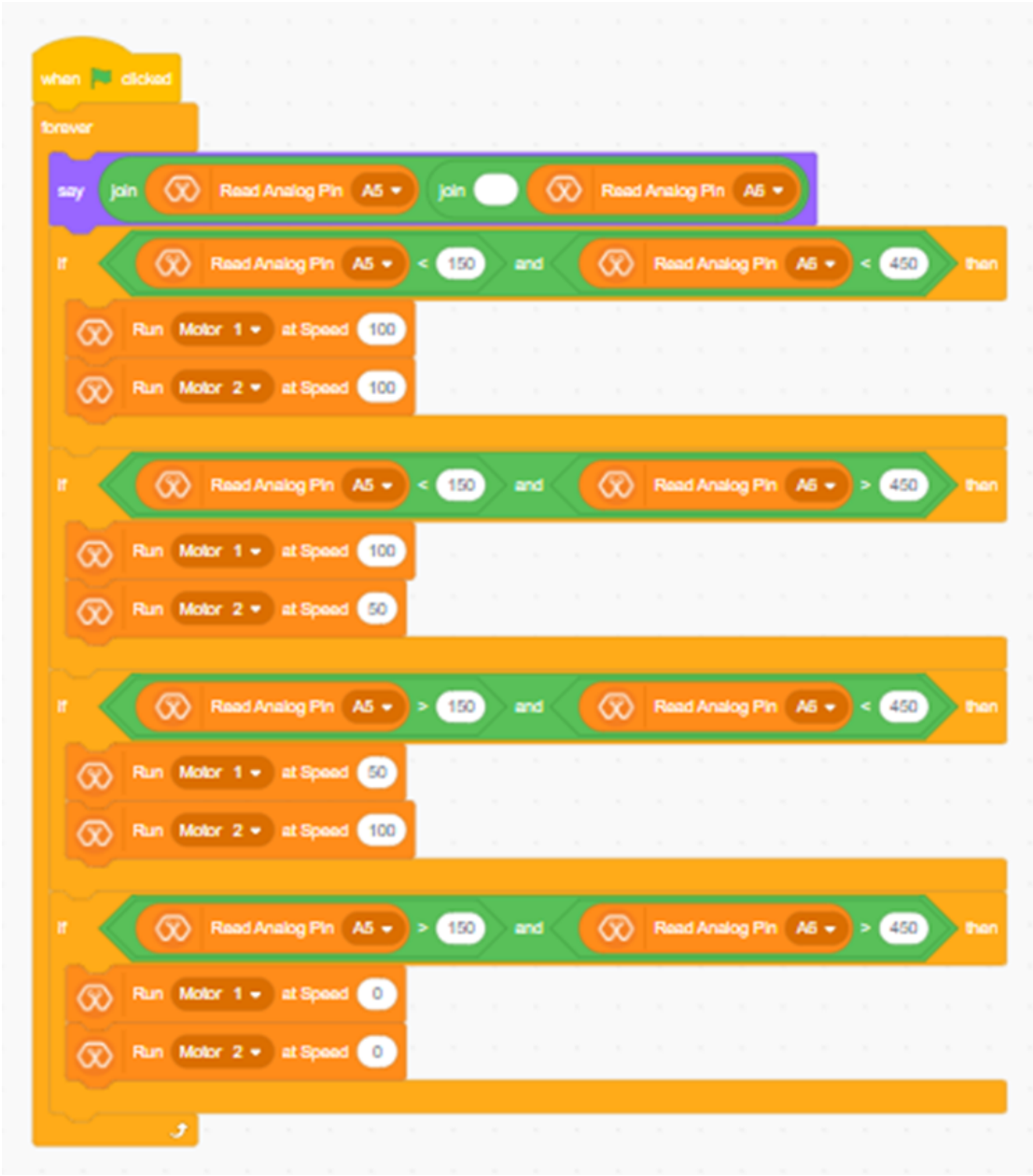




STEP 05 Make the program to follow the line by checking for the below conditions according to the IR sensor readings.

- 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 join Read Analog Pin A6
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

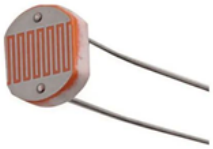
- Expected Output - https://youtu.be/hP4Kq4Hnfe0

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

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

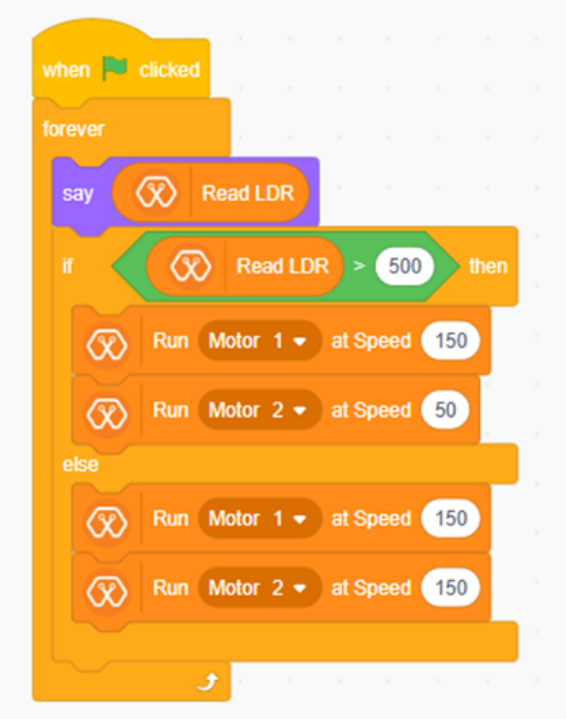
STEP 02 Get into the MagicCode platform - MagicCode 3.0 and connect Magicbit Tiny via Bluetooth

- 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

STEP 04 Make the final program



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

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

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

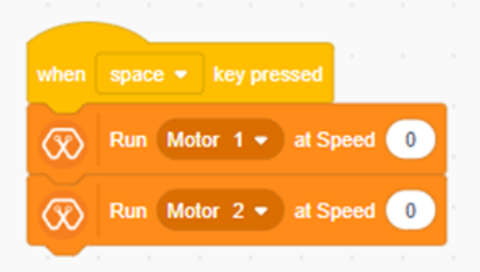
STEP 02 Flow of the program

- 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**

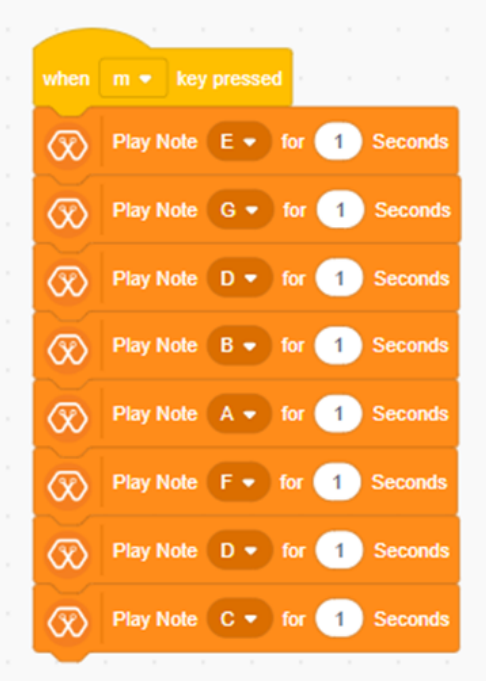
- Help Guide – Bluetooth Connection.pdf

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



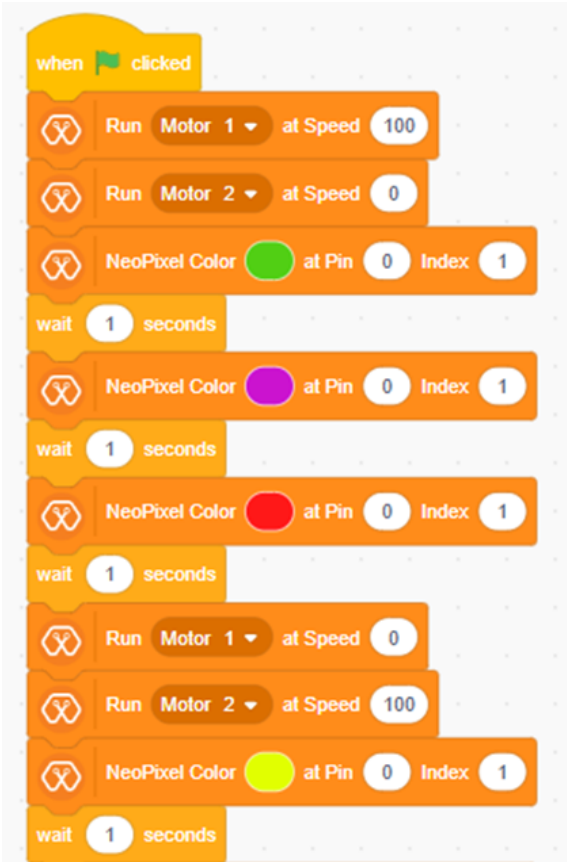
STEP 05 Make the code to hear the tones through the buzzer when any letter (eg:-M) is pressed.

- 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.



07. Obstacle Avoiding Robot Car

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

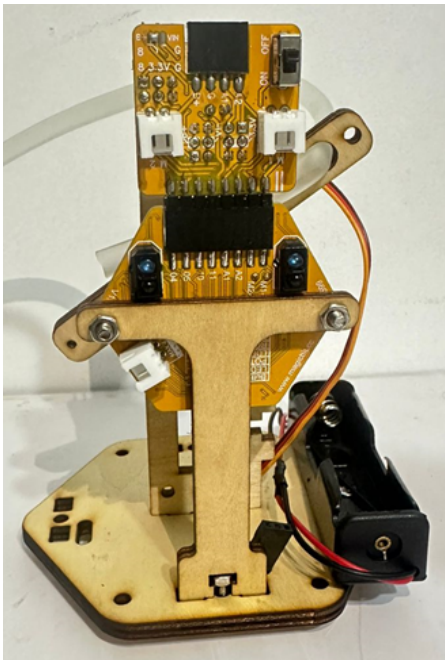
Steps for the Activity

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

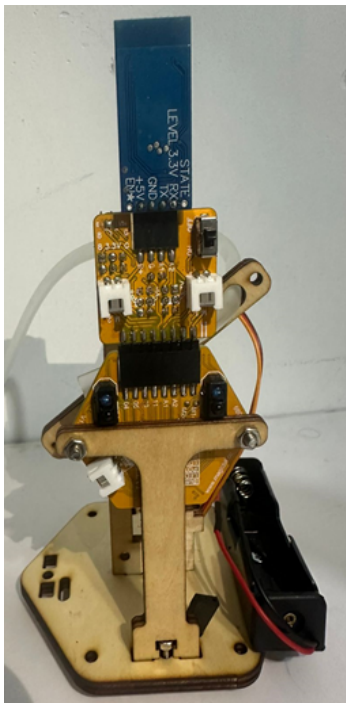
STEP 01 Create the set-up as in the given assembly guide.

- 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.

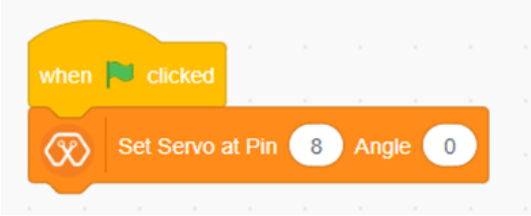


STEP 03 Understand the flow of the program

- Given rubber tube / saline tube is taking the water our 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.

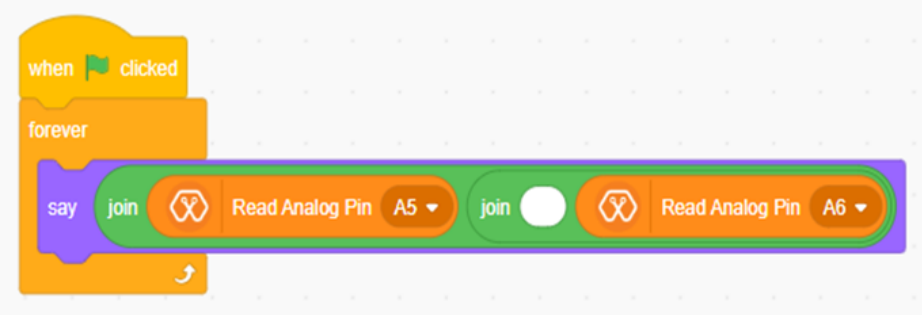
STEP 04 Measure the necessary servo angles.

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

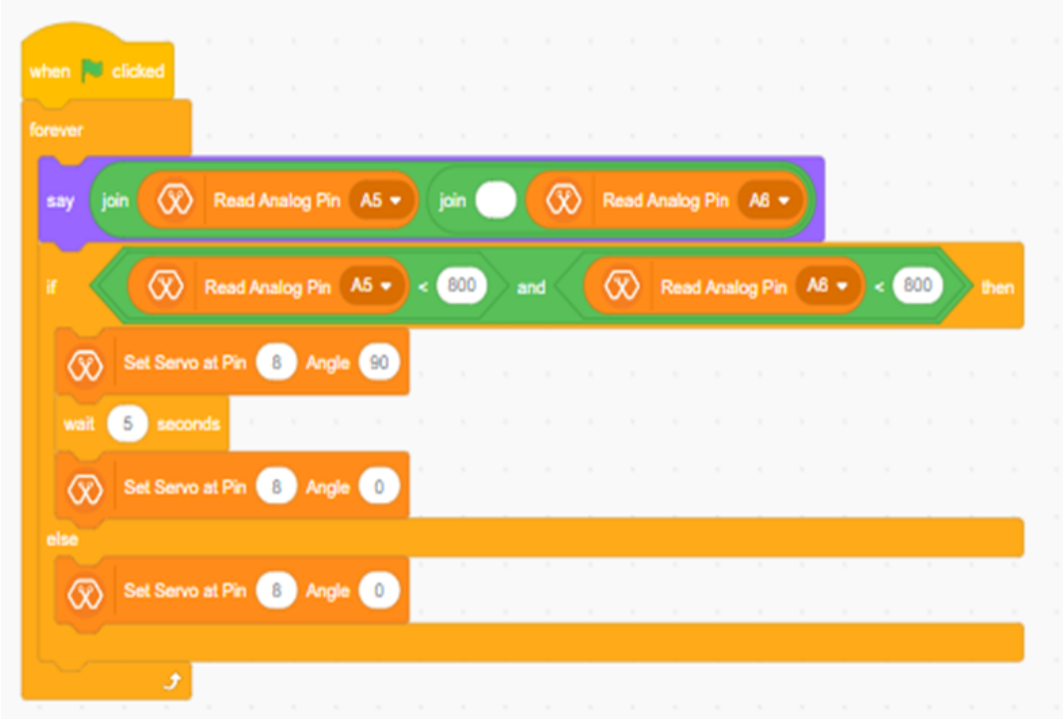


- Change the value at “Angle” different values in the range 0 -180 and get the necessary angles for above.

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



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



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 deleted 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

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

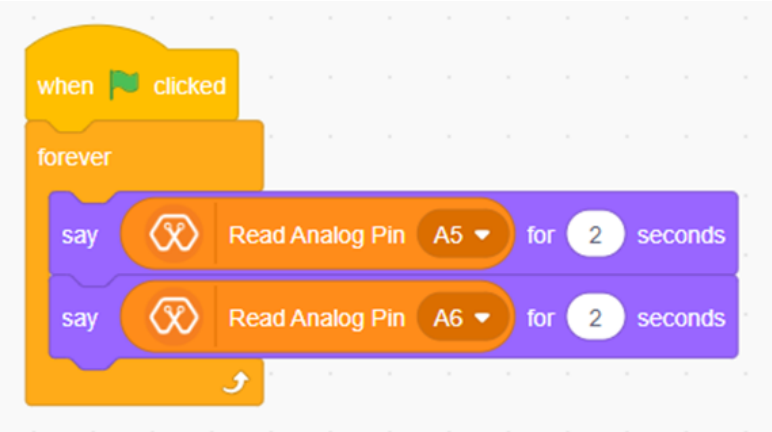
STEP 02 Connect the Set up MagicCode via Bluetooth.

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.

- As a result the plastic fan blade connected to the DC motor will rotate to extinguish the fire.
- 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.