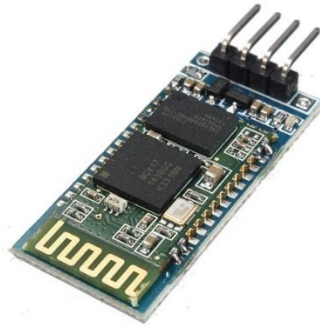


Magicbit Tiny with Scratch

Advanced Activities

Important – Continue with these lessons, you are required have a HC-06 Bluetooth Module (4 pins)



- **Learning Outcomes:-**

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

- **Lessons Outline**

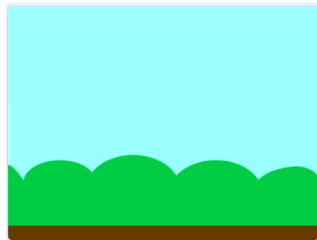
Lesson Number	Lesson Name
01	Apple collector - Animated Game
02	Bluetooth remote control car
03	Obstacle avoiding robot car
04	Line follower robot car
05	Automatic plant watering system
06	Automatic water tap
07	Object pushing Robot
08	Roach Robot
09	Smart Pet feeder
10	Fire fighter

01 - Apple Collector (Animated Game)

- Activity
 - 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
 - USB cable
 - Computer with Internet Connection
 - MagicCode Platform
- Steps for the Activity

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

- **Step 01** - Get into the MagicCode platform → [MagicCode 3.0](#) and connect Magicbit Tiny via USB
- **Step 02** - Get the necessary sprites and backdrop for the game - apple collector

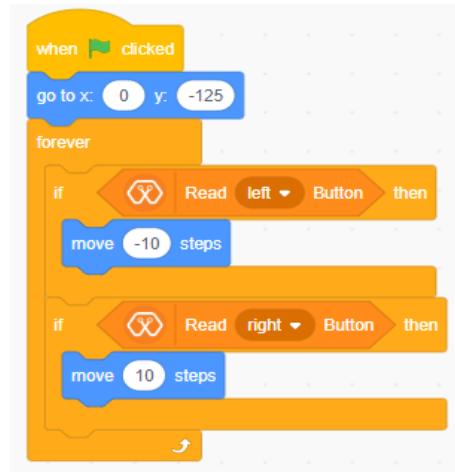


Backdrop

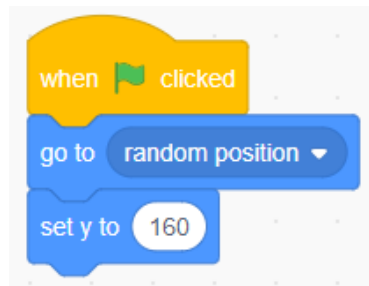


Sprites

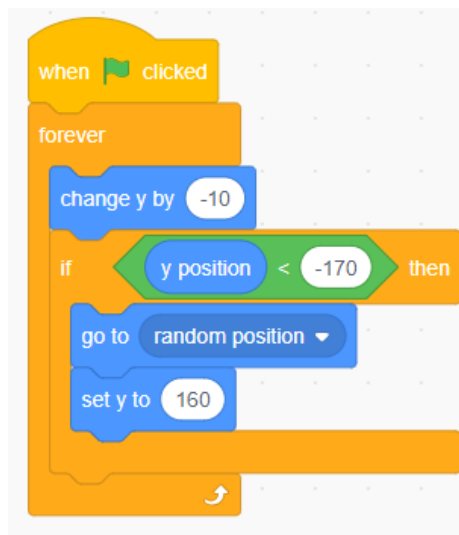
- **Step 05** - Make the programs for the sprites separately.
 - For the **“Bowl”** sprite - To move it along the stage using the tiny buttons



- 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



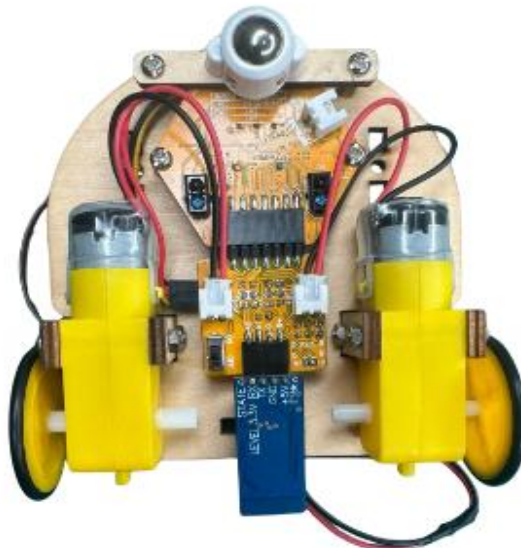
- **Step 06** - Make the game more challenging.

02 - Bluetooth-Remote Controlling Car

- Activity
 - 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

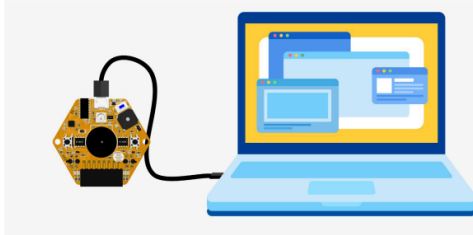
Expected Output - https://youtu.be/RYpIK_Ey0MU

- **Step 01** - Assemble the Tiny Robot using the provided the wooden parts
 - Use the below video for the robot assembling steps
 - <https://youtu.be/7O1pXeELhVc>
- **Step 02** - Connect the Bluetooth module to the car



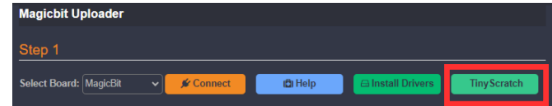
- **Step 03** - Get into the MagicCode platform → [MagicCode 3.0](https://magicbit.cc/magiccode/) and connect Magicbit Tiny using **Bluetooth mode**.

1. Connect the Magicbit Tiny to the computer via USB cable,

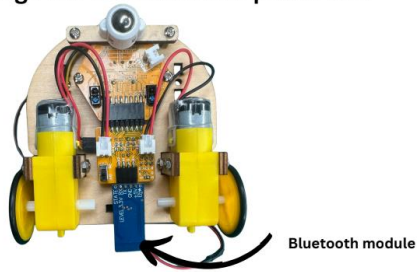


2. Update the firmware in Magicbit Tiny

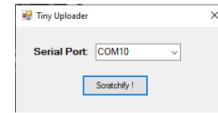
- Open Magicbit Web Uploader - <https://magicbit.cc/uploader/index.html>
- Click on the **"Tiny Scratch"** button and wait for a file to download



3. Connect the bluetooth module to the Magicbit Tiny through the extension and power ON.



- Open the downloaded file and run it to get the Tiny Uploader



- Select the correct serial port for your Magicbit Tiny connection
- Click on the **"Scratchify"** button and wait for it to install on Tiny board.



4. Add the bluetooth device to your computer

Bluetooth & other devices



- Use **1234** as the PIN



5. Open MagicCode Platform

<https://magicbit.cc/magiccode/>



6. Connect with the added bluetooth device

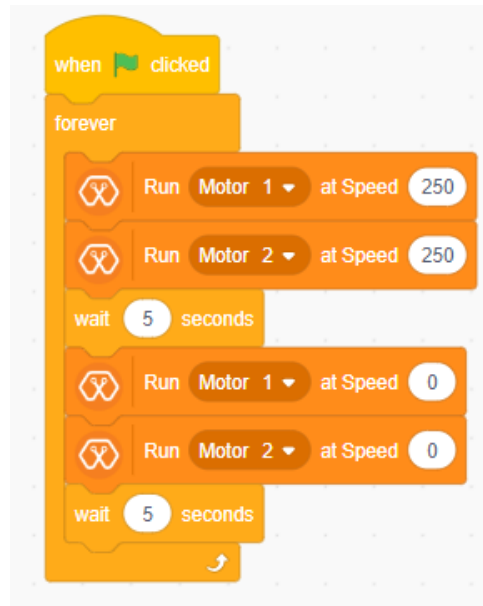
- Click on the **"Connect"** button



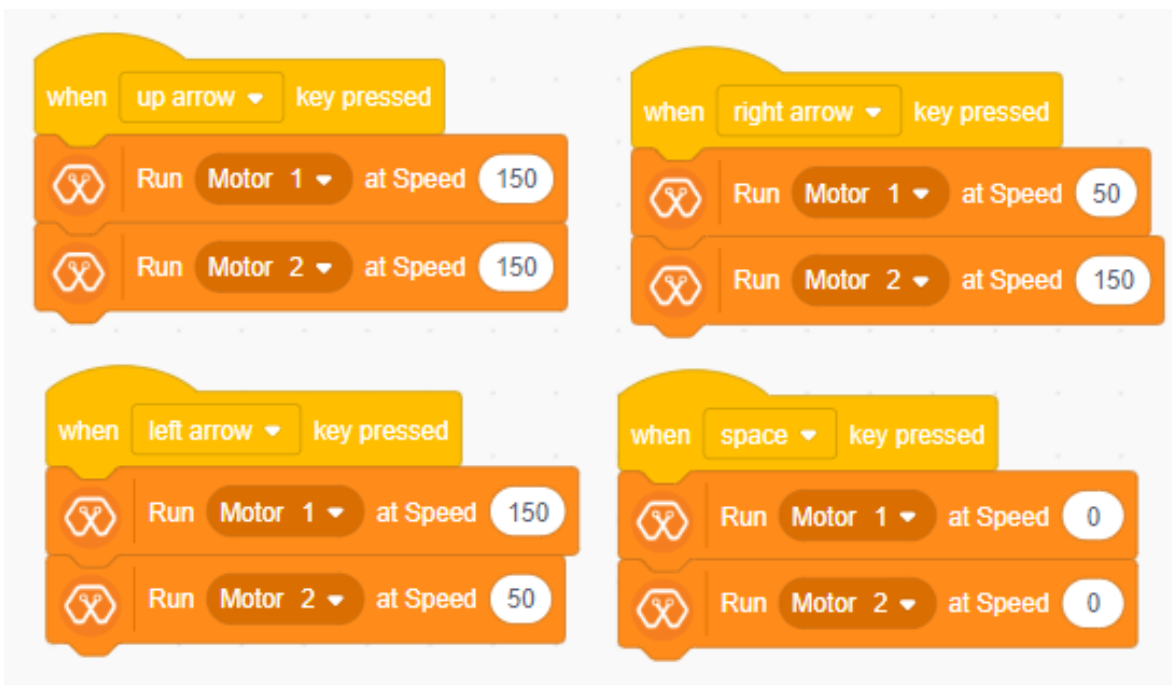
- Select added bluetooth device name in the pop-up to connect.



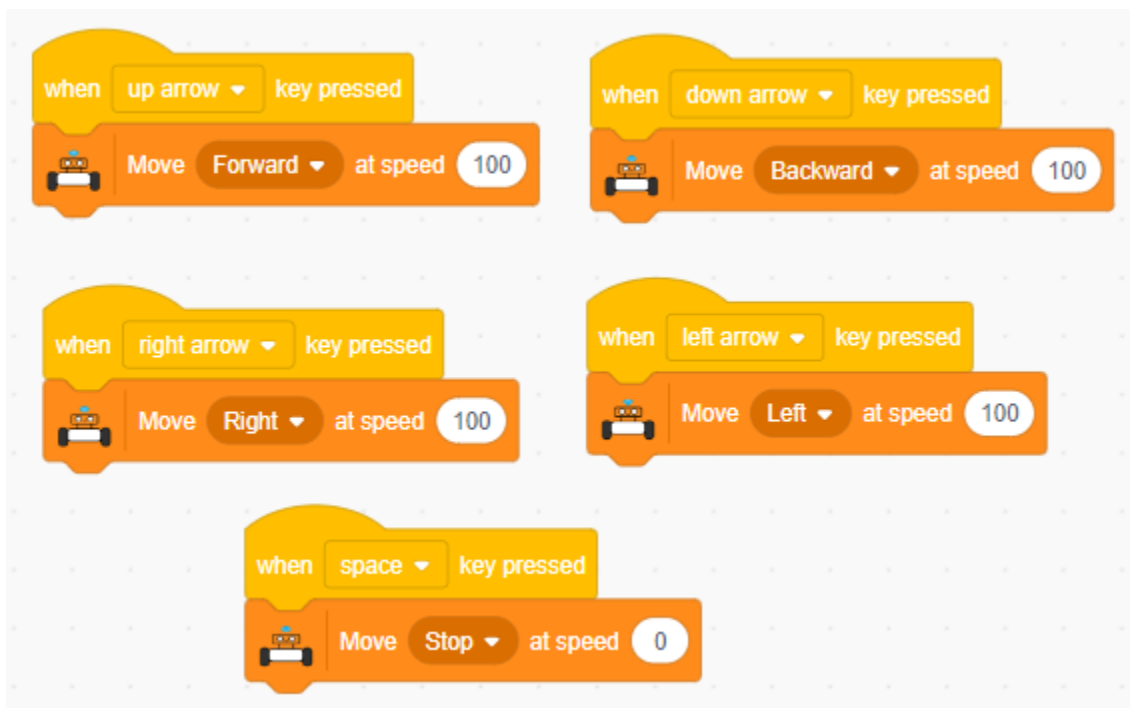
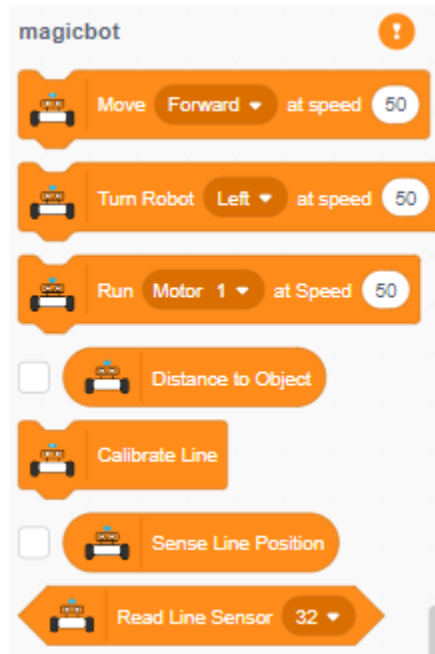
- **Step 04** - Recall motor controlling concepts
 - Relevant blocks
- **Step 05** - Make a simple program to control the motors



- **Step 06** - Make a program to move the robot in all directions when the arrow keys in the keyboard are pressed.



- **Step 07** - Try to do the same movements using the blocks in the “**Magicbot**” category.



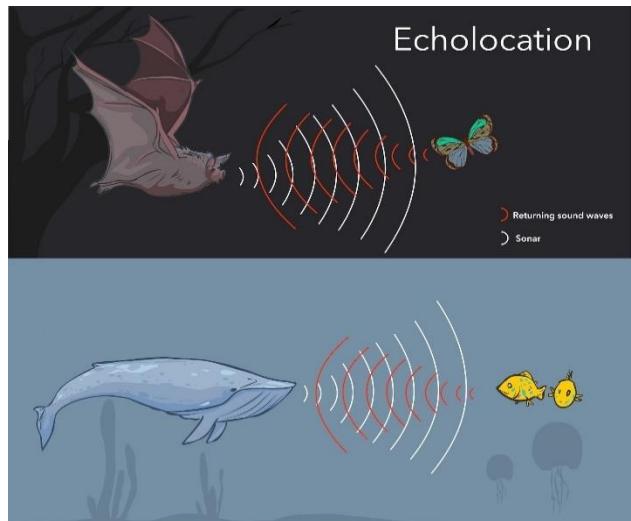
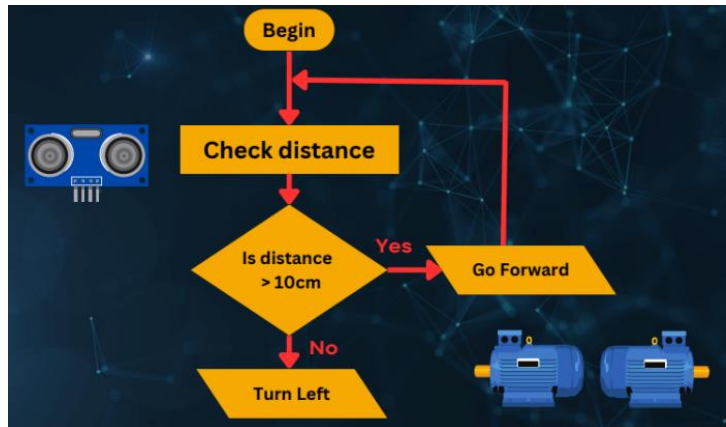
03 - Obstacle avoiding robot car

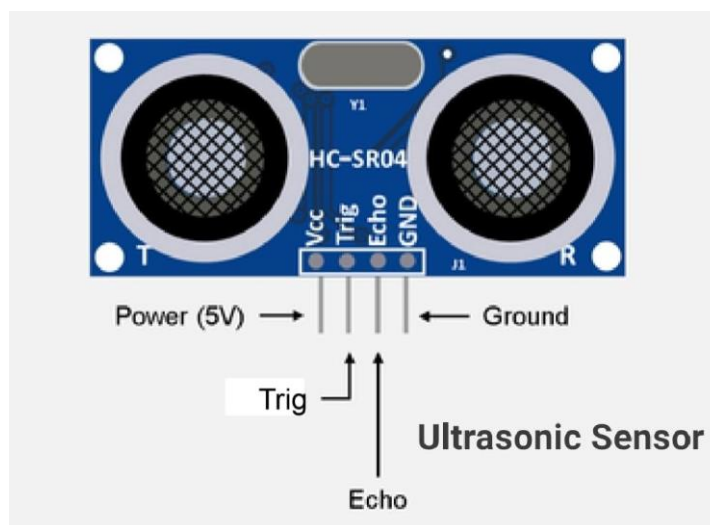
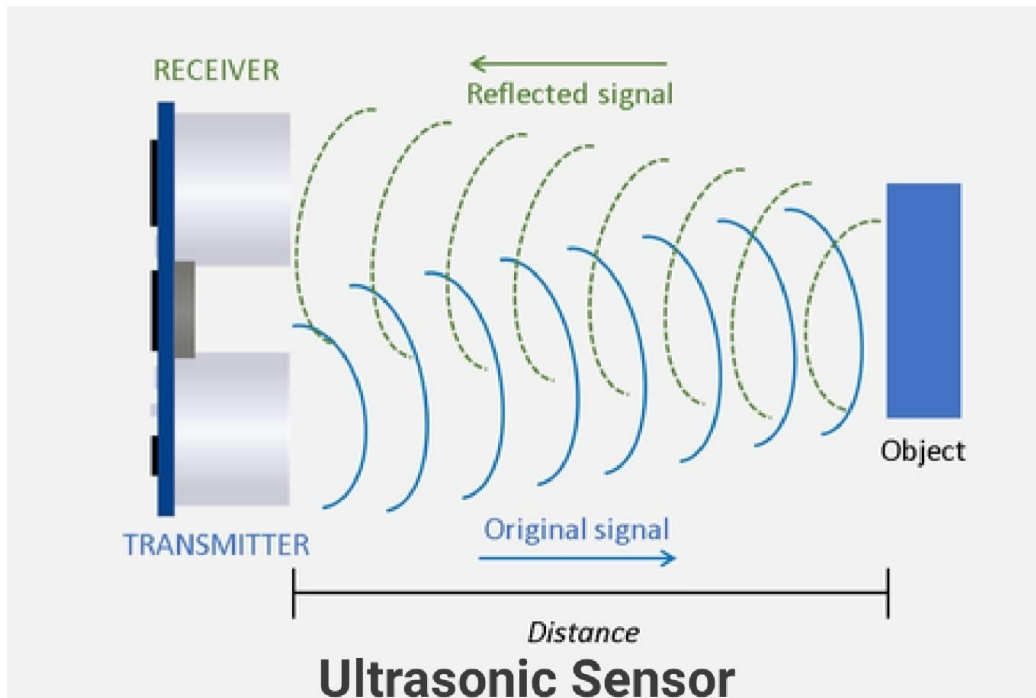
- Activity
 - Make a robot car which can move itself by avoiding the obstacles
- Learning Outcomes
 - Obstacle avoiding technique
 - Robotics Basics
- Materials Required
 - Magicbit Tiny Board
 - Computer with Internet Connection
 - MagicCode Platform
 - Wooden Robot platform
 - Bluetooth Module
 - Battery connector with batteries
- Steps for the Activity - Use the same robot assembled in Lesson 02

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

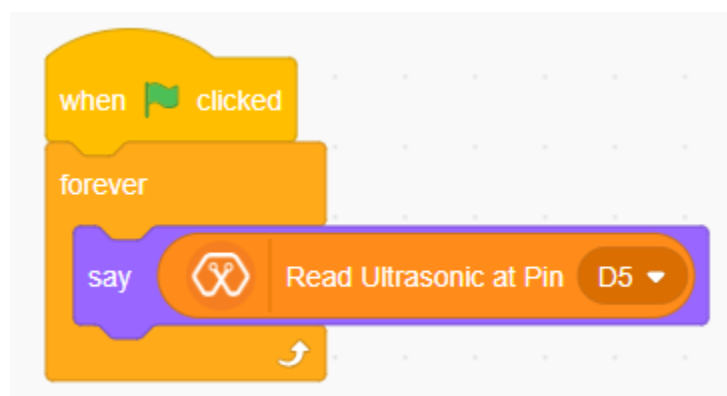
- **Step 01** - Connect the robot with [MagicCode](#) platform via Bluetooth

- **Step 02** – Understand the concept of avoiding obstacles

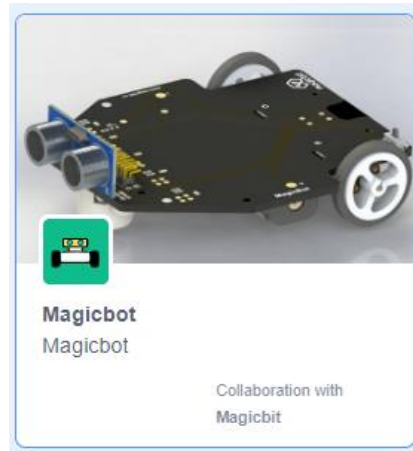
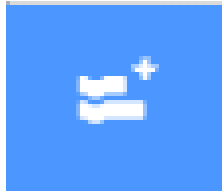




- **Step 03** - Make the program to get the distance measured by the ultrasonic sensor and display it on the stage. Connect the Ultrasonic sensor to D4 or D5 pins



- **Step 04** - Make the program to make the robot to avoid the obstacles and move
 - Add the Magicbot extension



```
when clicked
  forever
    if Read Ultrasonic at Pin D5 < 15 then
      Turn Robot Left at speed 50
    else
      Move Forward at speed 150
```

04 - Line following robot car

- Activity
 - Make a robot car which can move along a black line on a white surface following the line.
- Learning Outcomes
 - Line following technique
 - Robotics Basics
- Materials Required
 - Magicbit Tiny 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 in Lesson 02

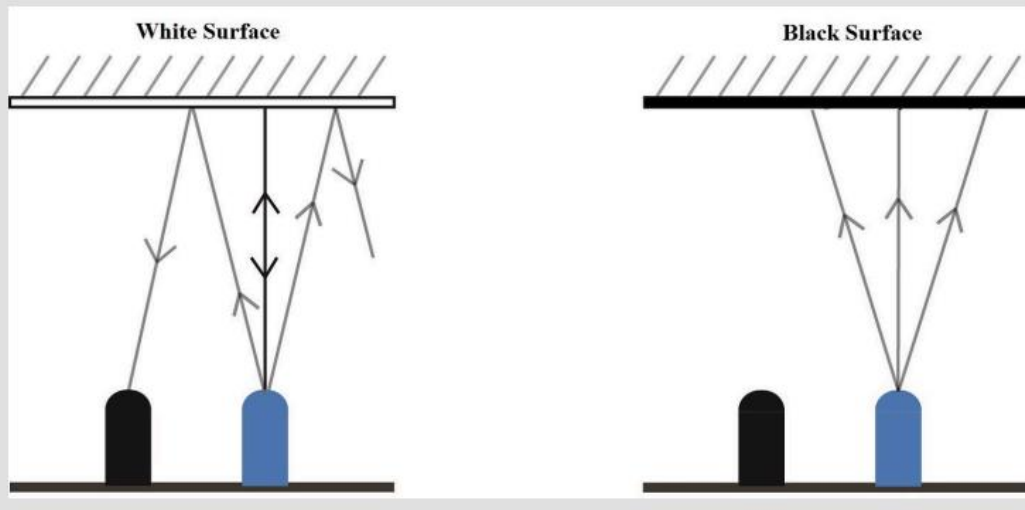
Expected Output - <https://youtu.be/nZds7kcdqco>

- **Step 01** - Connect the robot with [MagicCode](#) platform via Bluetooth
- **Step 02** – Understand the concept used to follow the line
 - Industrial usage of line follower robots -
https://www.youtube.com/watch?v=peOM_Nk4AEY

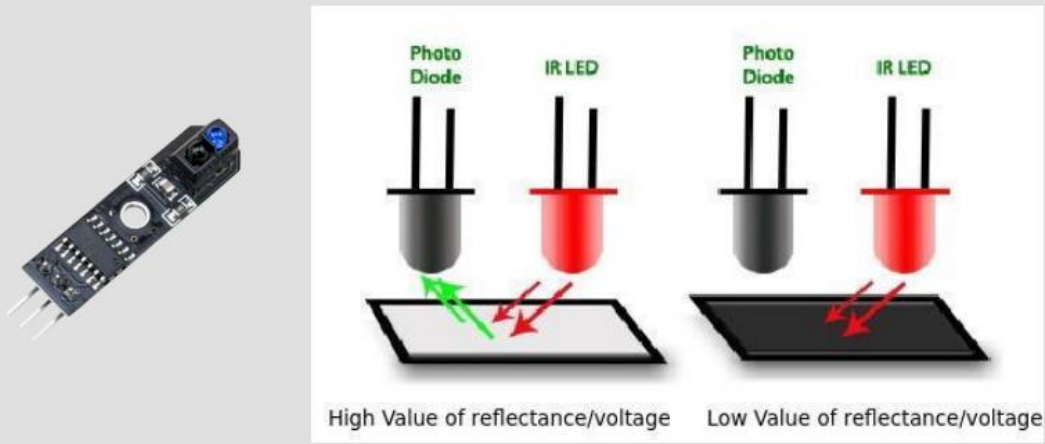


Line Following Robot

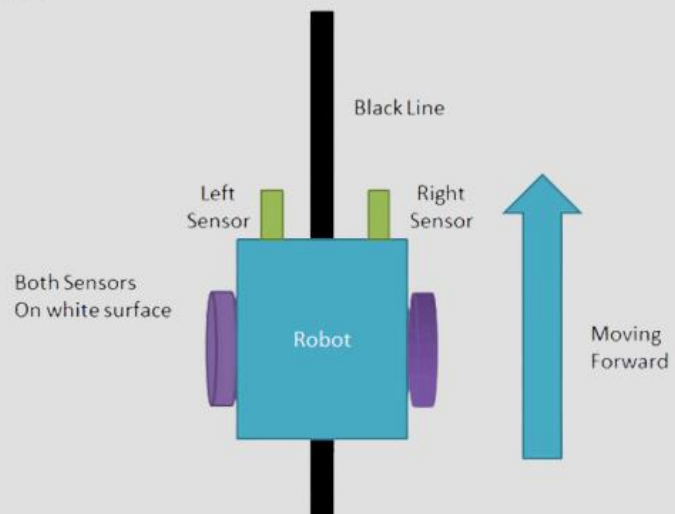
Black and White Identification



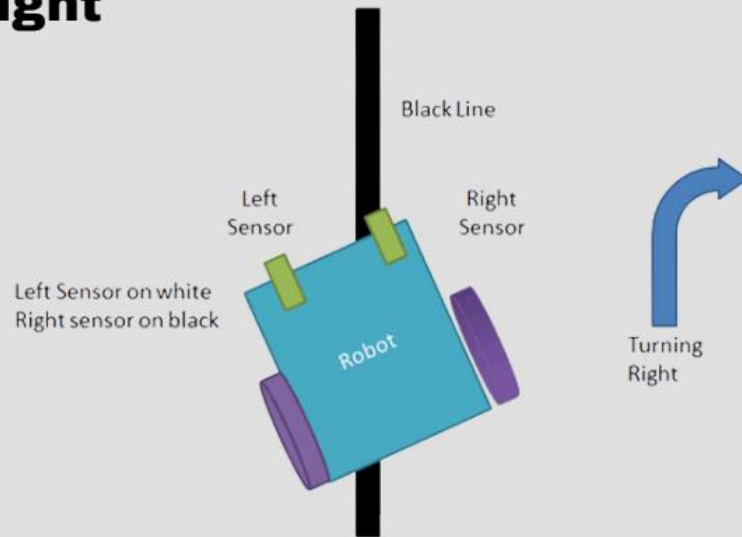
IR Proximity / Line Tracking Sensor



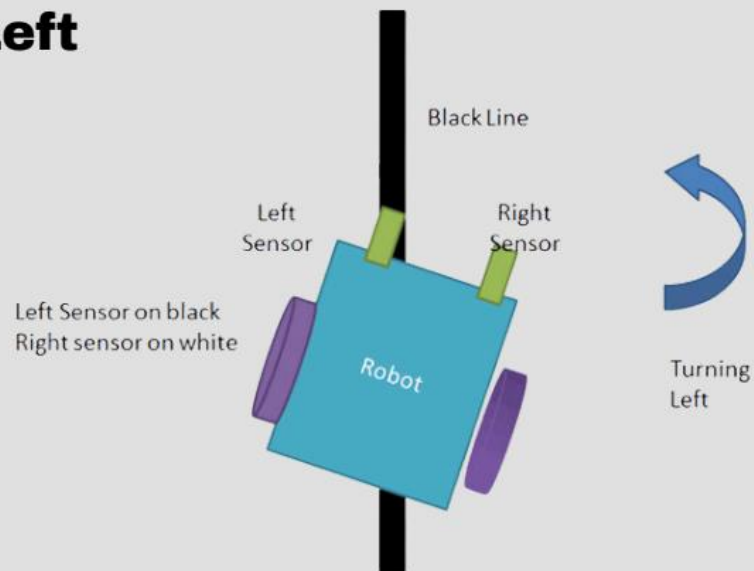
Forward Motion



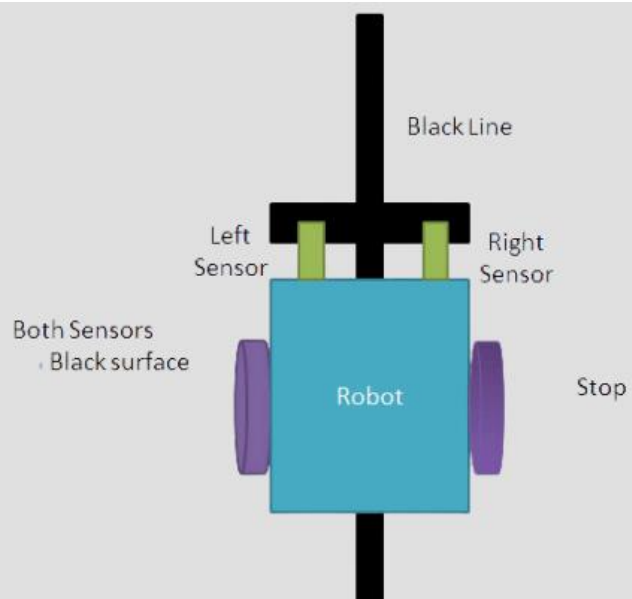
Turning Right



Turning Left



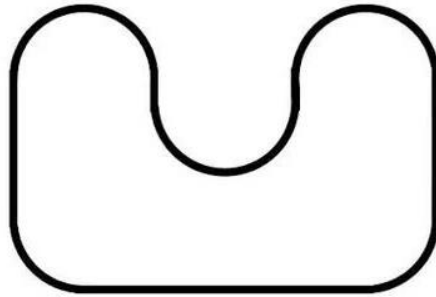
Stop



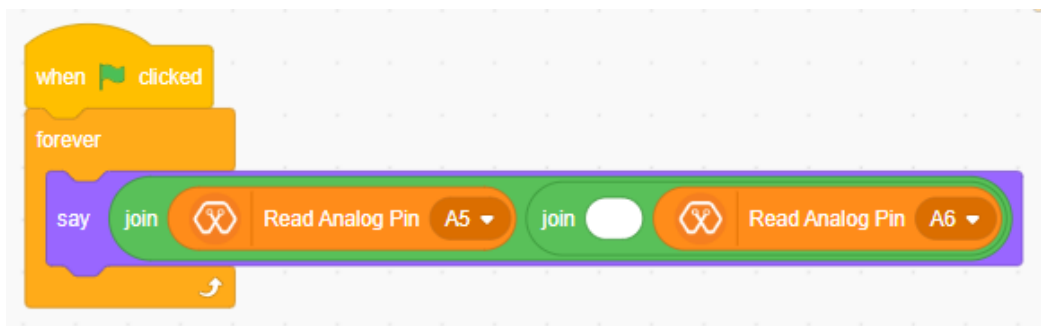
- **Step 03** - Make a black track / line on a white surface to test the robot
 - Printable Black Track -

<https://drive.google.com/file/d/1hNrdazskvo0TiJwfUG0tOLLoG9YEQq5S/view?usp=sharing>

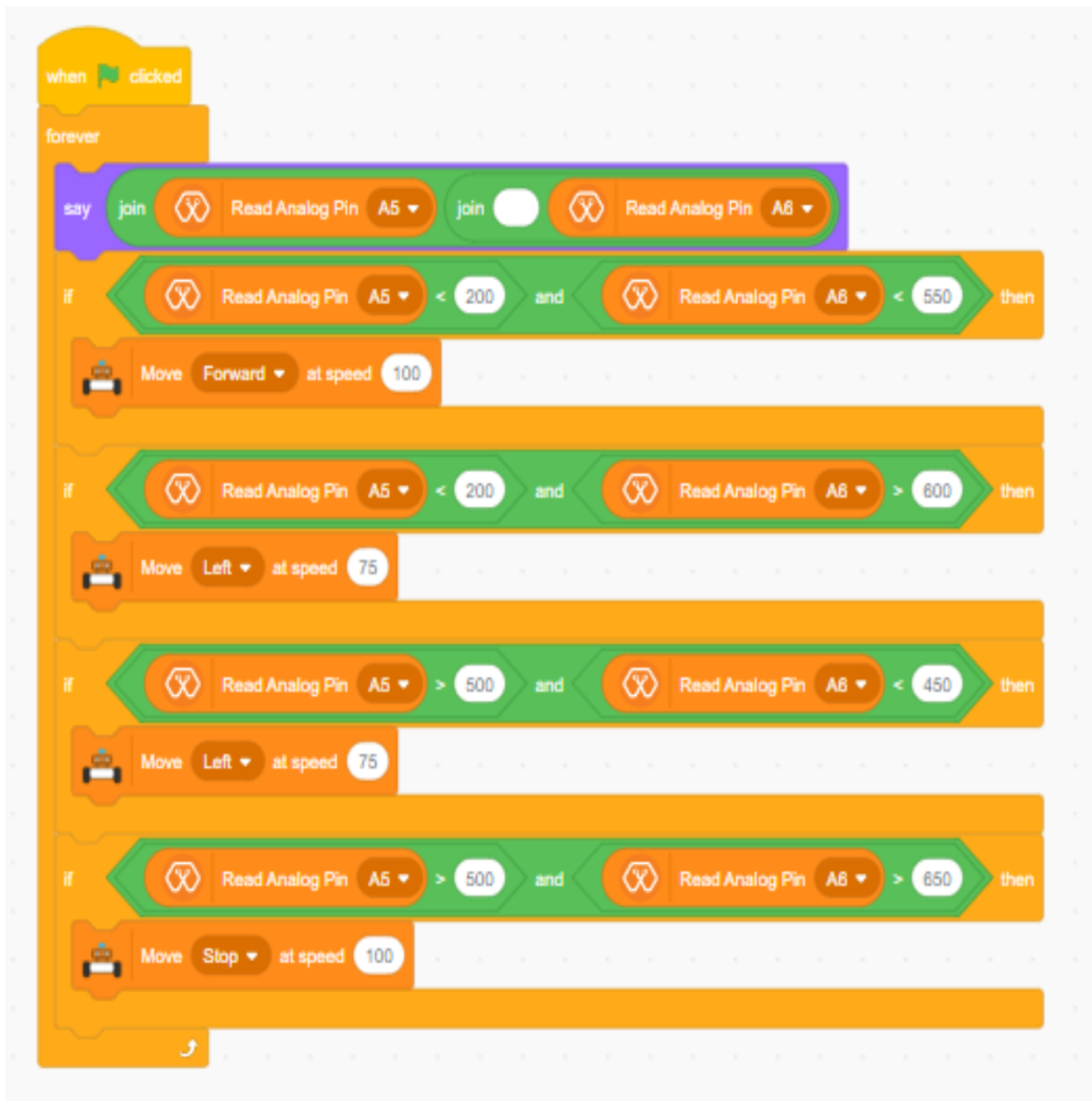
Important - This document is scaled to A2 size.



- **Step 04** - 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



05 - Automatic Plant Watering System

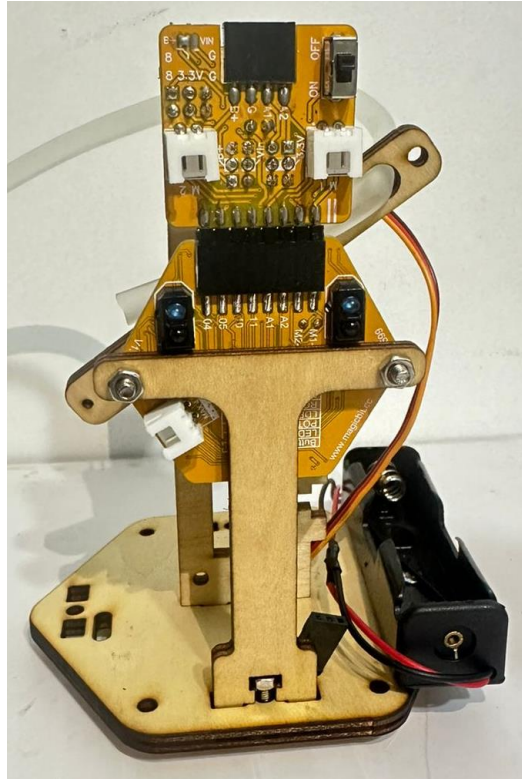
- Activity
 - Develop a system that water a plant pot automatically based on the time intervals
- Learning Outcomes
 - Practical application of the concepts
 - Servo motor operation
- Materials Required
 - Magicbit Tiny Board
 - Computer with Internet Connection
 - MagicCode Platform
 - Wooden Servo setup
 - Bluetooth Module
 - Rubber tube
 - Plastic bottle / small container
 - Small real plant pot
 - Servo Motor
 - Battery connector with batteries
 -
- Steps for the Activity

Expected Output - <https://youtu.be/JVMcvTRdU14>

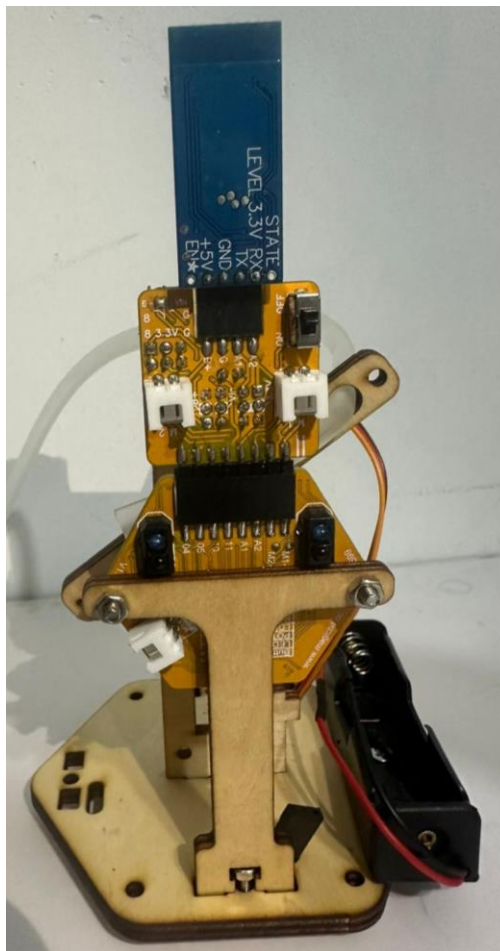
- **Step 01** - Create the set-up as in the given guide.

Set-up Assembly guide - <https://youtu.be/32J6sWqjU4w>

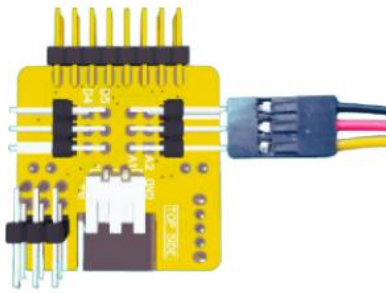
Important - Fix the Magicbit tiny in an up-side-down way and the tiny extension accordingly.



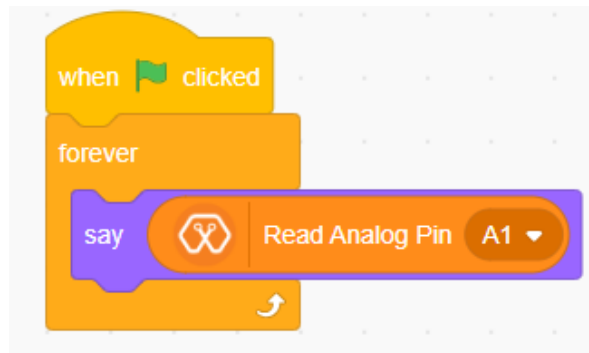
- **Step 02** - Connect the Bluetooth module to the Tiny extension as below.



- **Step 03** - Connect the Soil Moisture sensor to the **A1 or A2 pin** in the tiny extension

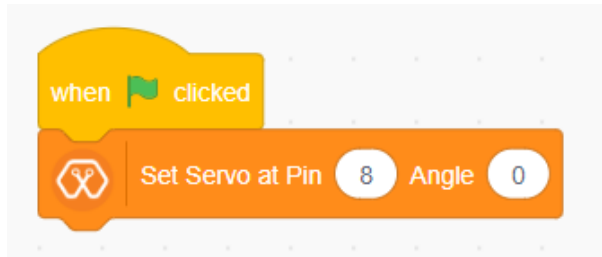


- **Step 04** - Test the readings variation in soil moisture sensor
 - Make the below program



- **Step 05** - 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 may happen in given time intervals

- **Step 06** - Measure the necessary servo angles.
 - For water pouring / outgoing position
 - For stopping the water flow



- **Step 07** - Make the final program to operate the servo into necessary angles according to the readings from the moisture sensor



06 - Automatic water tap

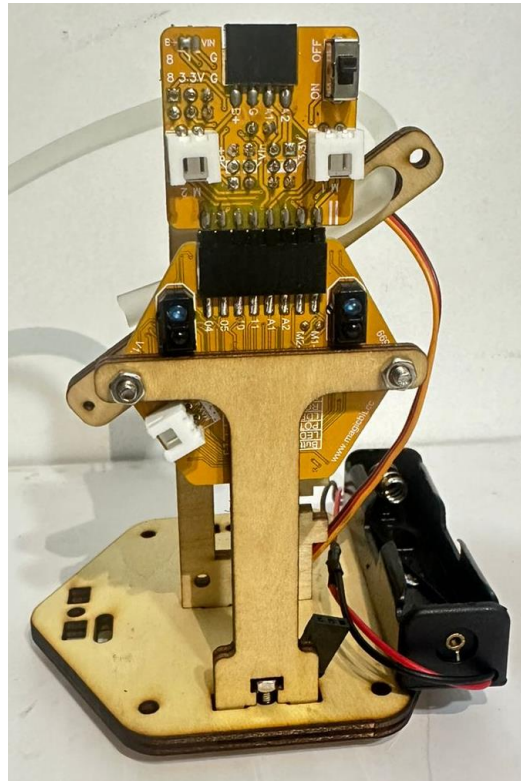
- Activity
 - Develop a system that functions as a water tap which operates automatically.
- Learning Outcomes
 - Practical application of the concepts
 - Servo motor operation
 - IR proximity sensor readings
- Materials Required
 - Magicbit Tiny Board
 - Computer with Internet Connection
 - MagicCode 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.

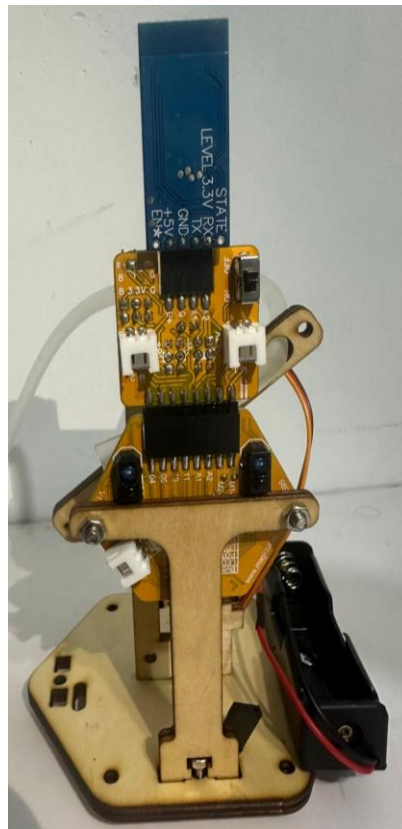
Set-up Assembly guide - <https://youtu.be/WQjZGKnaChQ>

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



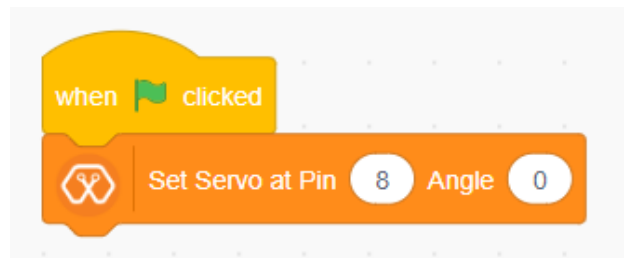
- **Step 02** - Connect the Bluetooth module to the Tiny extension as below.

○



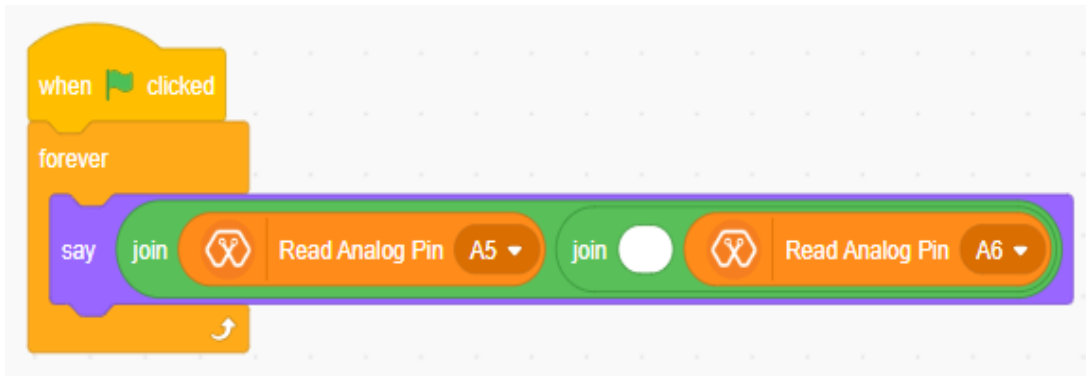
- **Step 03** - Understand the flow of the program
 - Given rubber tube / saline tube is taking the water out from the water container (Can use a plastic water bottle as the container)
 - One end of the rubber tube is inserted to the water container and the other end is taken through the wooden arm connected 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

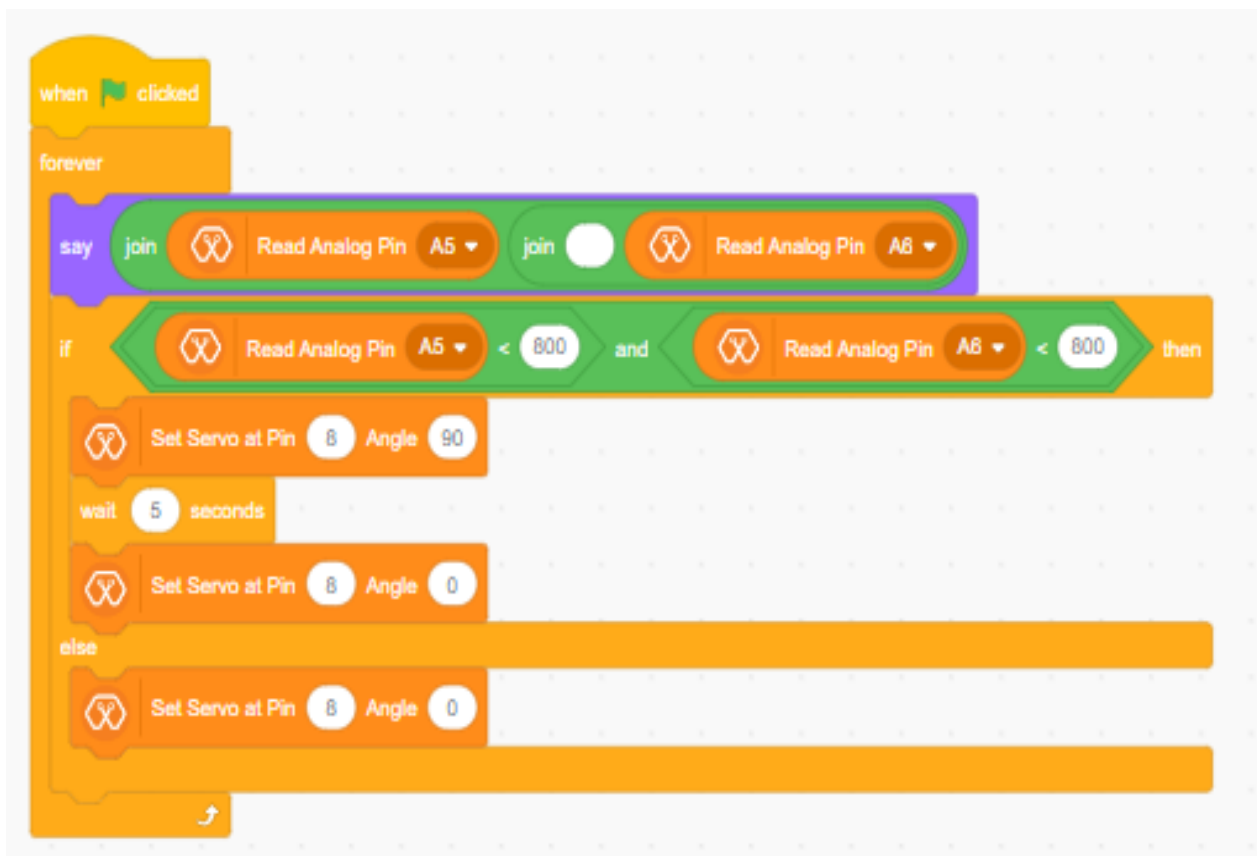


- Change the value at "Angle" different values in the range 0 -180 and get the necessary angles for above.

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



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



07 - Object Pick-Up robot

- Activity

- Build a robot with an arm that can pick up and move objects detected by sensors.

- Learning Outcomes

- Practical application of the concepts
- Servo motor operation

- Materials Required

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

- Steps for the Activity

Expected Output - <https://youtu.be/31B12WFps18>

- **Step 01** - Modify the same robot with the robot arm.

Robot Assembly guide - <https://youtu.be/7O1pXeELhVc>

- **Step 02** - Connect the robot with [MagicCode](#) platform via Bluetooth

- **Step 03** – Understand the mechanism used here

- Industrial usage of object pick up robots -

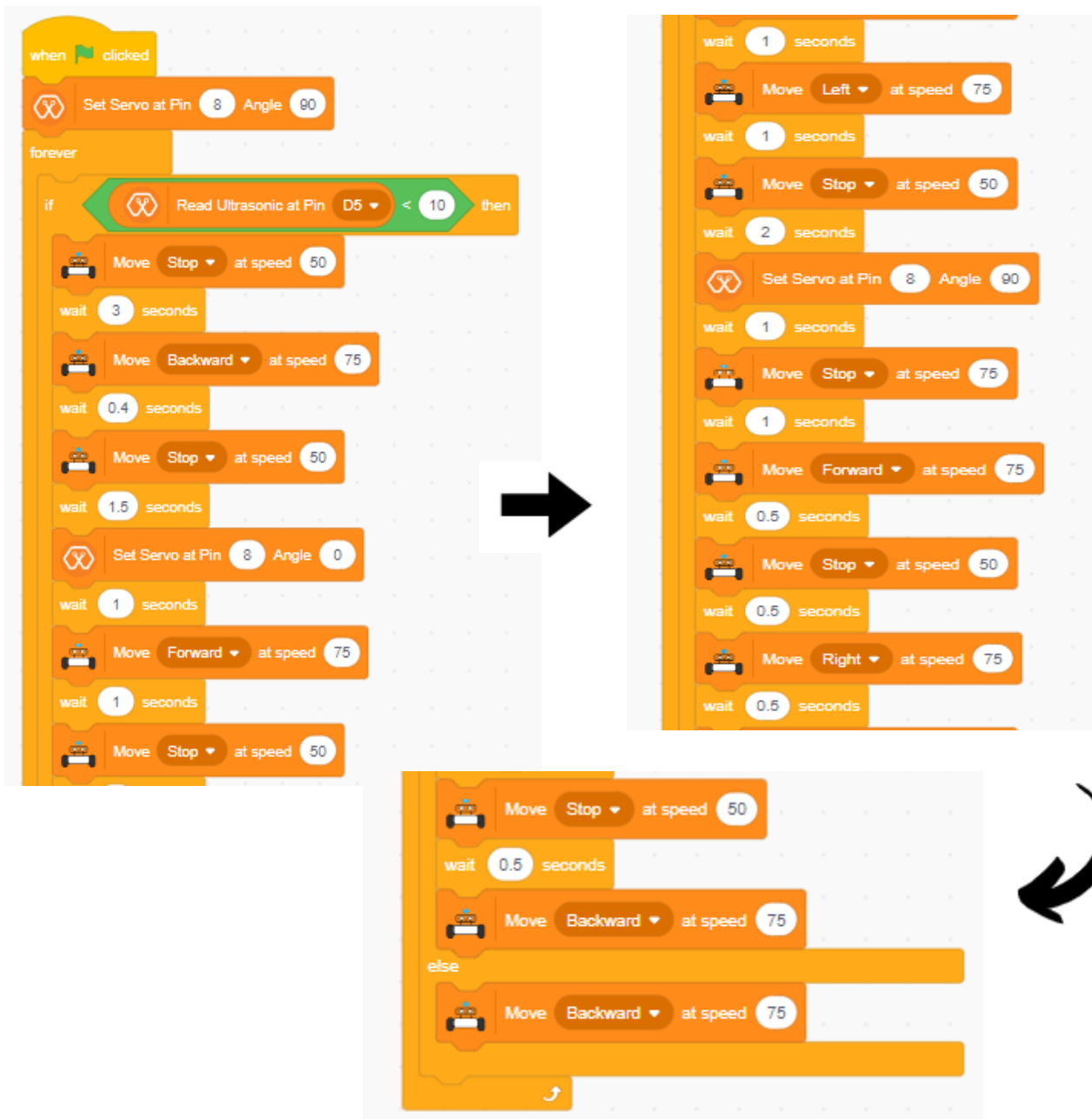
https://www.youtube.com/watch?v=peOM_Nk4AEY

- Technique of identifying the objects and grabbing them

- Ultrasonic sensor - To identify the objects
- Servo motor (arm) - Grab the objects

- **Step 04** - Measure the necessary servo angles.
 - Position of the arm when the car is in normal motion
 - Position of the arm when an object is detected

- **Step 05** - Make the program
 - Move the car
 - Detect the objects
 - Stop the car when an object is detected
 - Operate the arm to grab the object and move the robot in reverse and take necessary turns
 - Operate the arm to release the object and continue robot's motion



08 - Roach Robot

- Activity
 - 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
 - Computer with Internet Connection
 - MagicCode Platform
 - Wooden Robot platform
 - Bluetooth Module
- Steps for the Activity

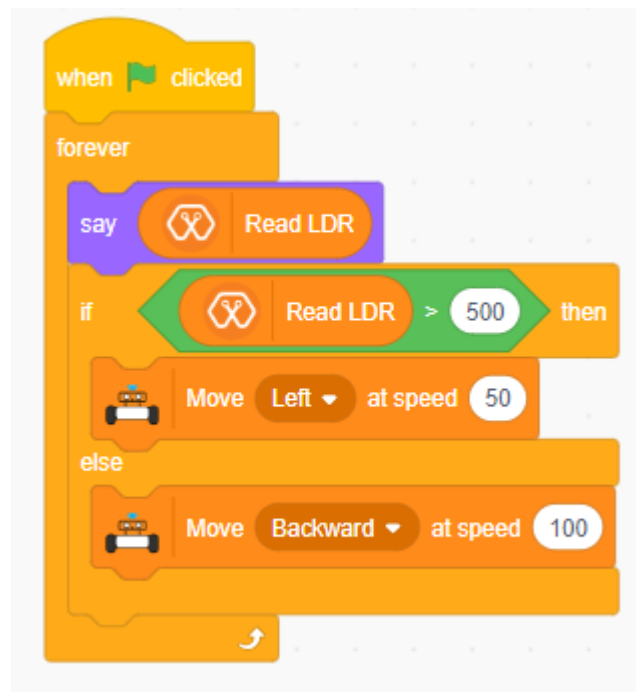
Expected Output - <https://youtu.be/hP4Kq4Hnfe0>

- **Step 01** - Assemble the robot as guided below (same robot used in previous lessons)
 - Robot Assembling video - <https://youtu.be/7O1pXeELhVc>
- **Step 02** - Understand the mechanism used
 - The robot is sensitive to environmental light intensity.
 - The environmental light intensity is measured using the LDR sensor in the Magicbit Tiny board.
 - When the detected light intensity is higher than the given threshold value, the robot will change its moving direction to left or right direction. Unless it will continue the motion to forward direction.

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



- **Step 04** - Make the final program



- **Step 05** - Update the program to switch between different colors in RGB according to different light conditions while making the motion.

09 - Pet Feeder

- Activity

- Develop a system that functions as an automatic pet feeder when the pets are detected.

- Learning Outcomes

- Practical application of the concepts
- Servo motor operation

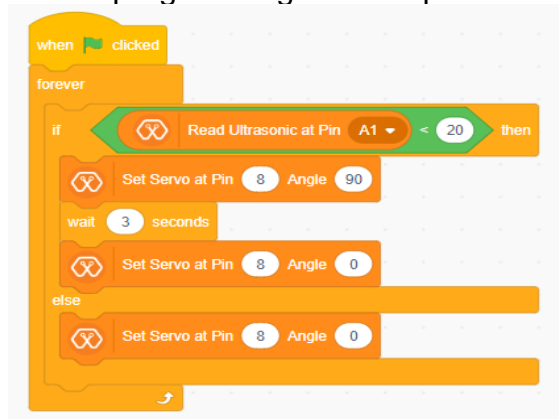
- Materials Required

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

- Steps for the Activity

Expected Output - <https://youtu.be/JvumVDf2m-Q>

- **Step 01** - Make the set up as in the above video.
- **Step 02** - Understand the mechanism used
 - Presence of pet within a given range is detected using the ultrasonic sensor
 - Then servo motor is rotated to drop the pet food from the container to the below dish.
 - Wait few seconds or minutes at that position and rotate back to the previous position
- **Step 03** - Make the program to get the required servo motor angles.



10 - Fire Fighter Robot

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

- **Activity**
 - 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**

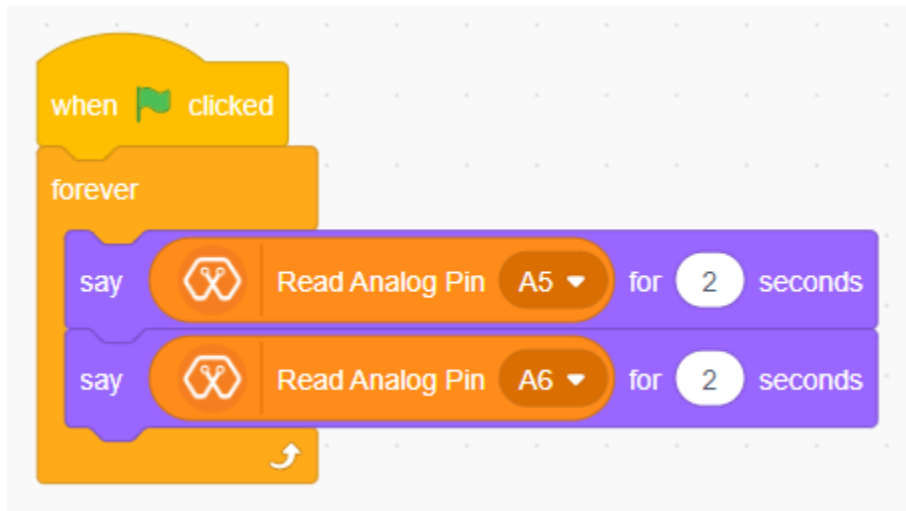
Expected Output - https://youtu.be/UQOP2HUw_5A

- **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.

