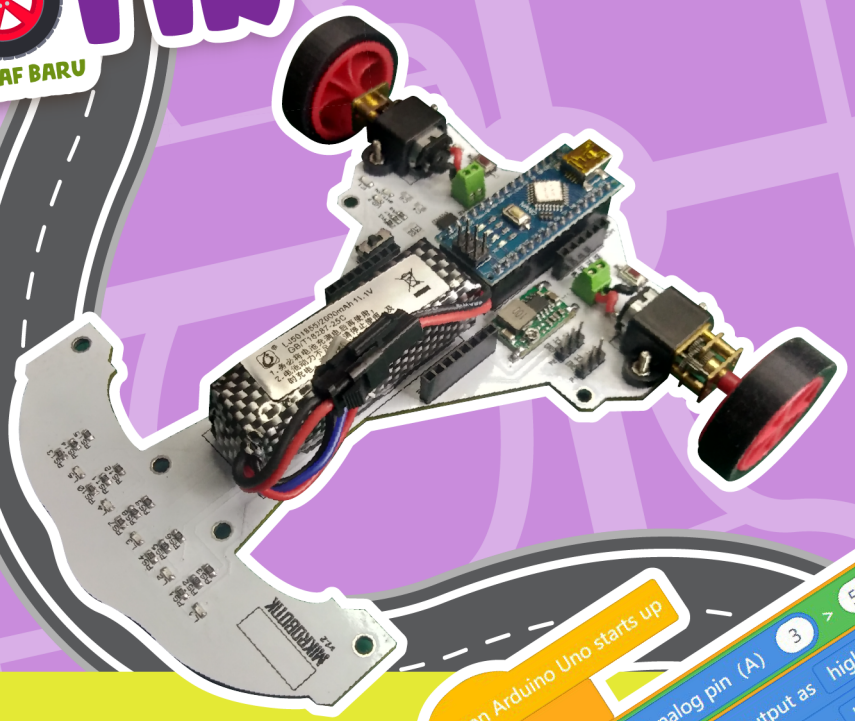
MCT
MICRO CONCEPT TECH

EKSPLORASI ILMU

MIKROBOTIK

KIT PEMBELAJARAN ROBOTIK ALAF BARU



- Robot pembelajaran dengan spesifikasi pertandingan.
- Pergerakkan berautonomi mengikut garisan.
- Pergerakkan bebas dengan kawalan 'Bluetooth'.
- Pengekodan grafik yang mudah dan seronok.

UMUR 7+

Contents

Mechanical Structure

Mechanical Movement

Element of Robotics

Electronic Hardware

Software Coding

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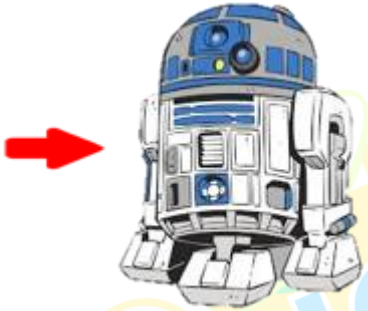
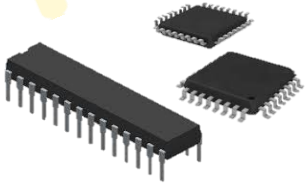
What is Electronic Hardware?

Detects and senses the surrounding



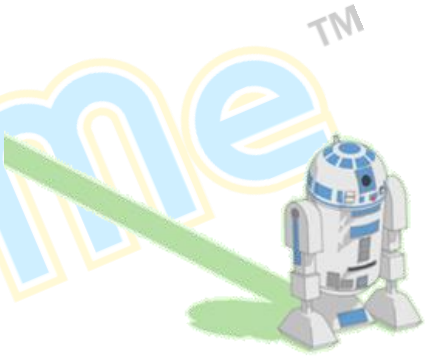
Controls or reacts to surrounding



What is Software Coding?

Sets of instruction written in specific language

Electronic Hardware Controller



Operate

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Path Finding Robot

Robot designed and built specifically to detect and autonomously follow white and black line. Besides. robot also designed for other functions such as obstacle detector and moving small objects.

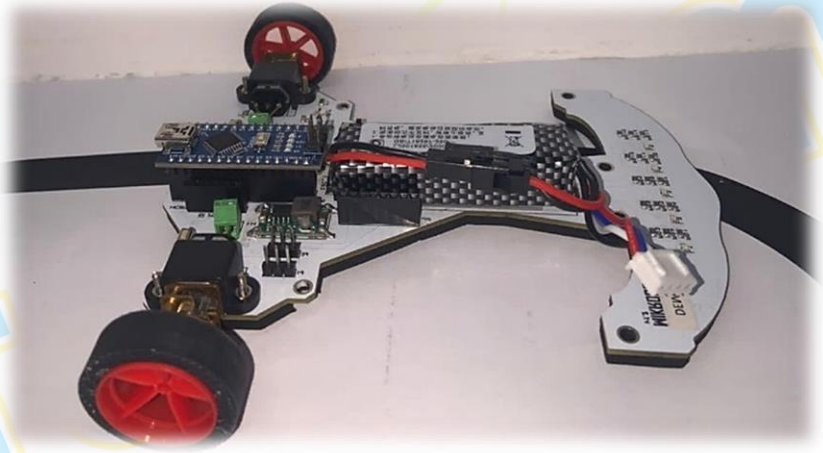


Figure 1: "*Mikrobotik*" Pathfinding Robot

Contents in the box

1x Usb Cable
1x Charger
1x Mikrobotik
1x Bluetooth Module
1x Mikrobotik Track

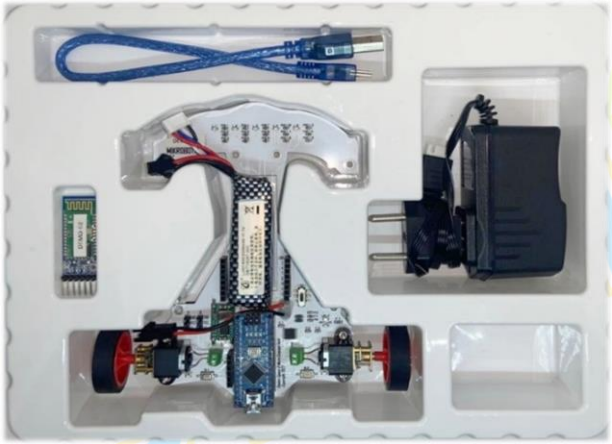


Figure 2: Mikrobotik Set

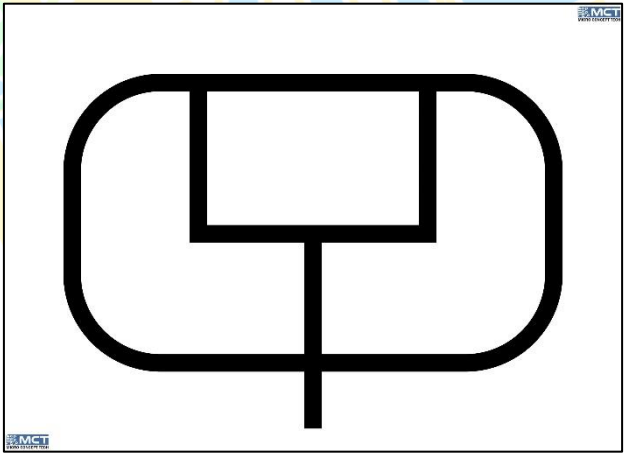
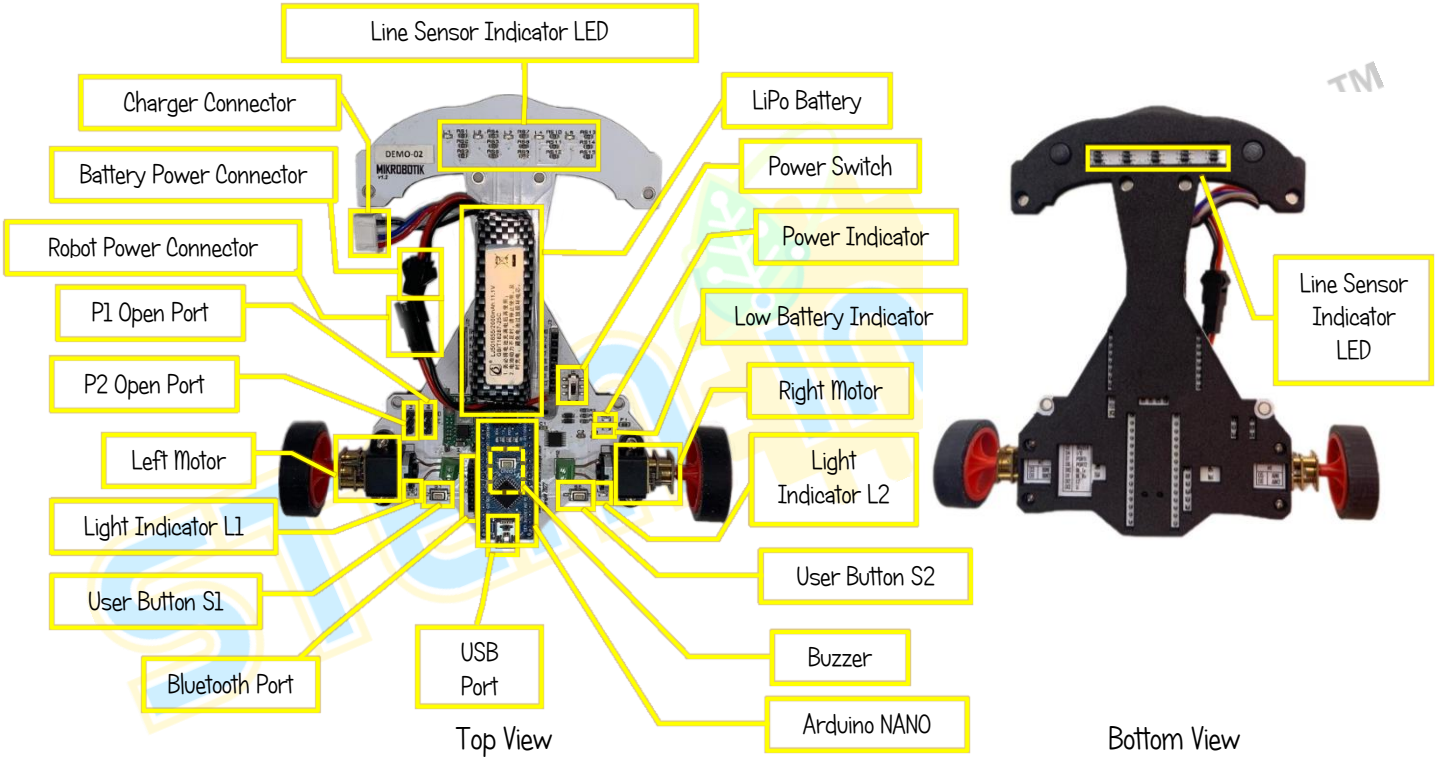


Figure 3: Mikrobotik Track

"Mikrobotik" Pathfinding Robot



Arduino Nano Microcontroller

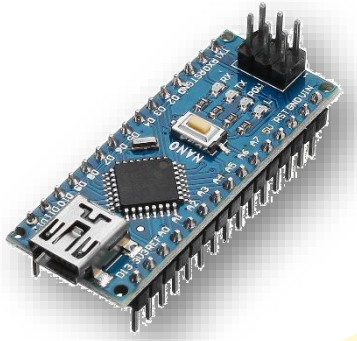
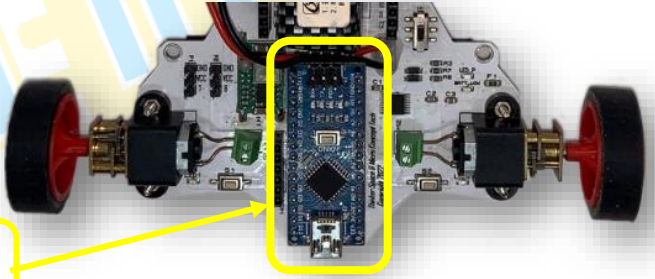


Figure 4: Arduino Nano Atmega328p

A microcontroller is a device that handles core functions such as controlling the use of other electronic hardware connected to it. analyzing data and executing logic.

Mikrobotics uses an Arduino Nano microcontroller that acts as the brain to control the entire hardware and movement of the robot.



Arduino Nano microcontroller on Mikrobotik

LiPo Battery

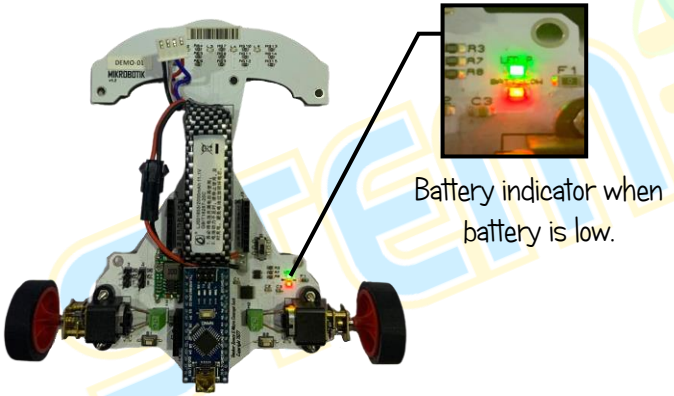
Lithium Polymer (LiPo) batteries are rechargeable lithium-ion battery technology that uses a polymer electrolyte instead of a liquid electrolyte. They function by providing a higher specific energy than other types of lithium batteries and are used in applications where weight is a critical feature.

Mikrobotics utilizes an 11.1V LiPo battery to ensure that maximum speed can be achieved for movement..

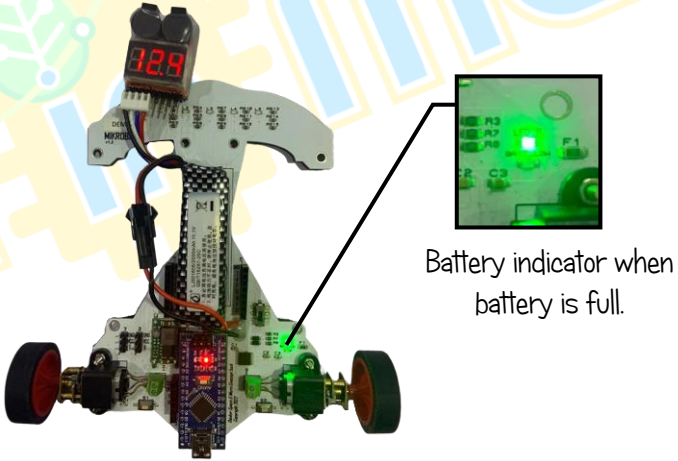
Low Battery Indicator

Low battery indicator will light up red colour.
The lower the voltage value in battery. the brighter the indicator.
Minimum voltage operated: 11.0 V (Low battery indicator light at maximum bright)

User need to stop using Mikrobotik and start charging when low battery indicator lights at maximum.



Battery indicator when battery is low.



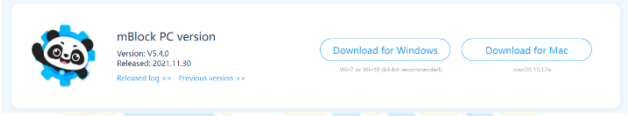
Battery indicator when battery is full.

Installation of mBlock v5

Step 1 mBlock v5 software can be obtained from:

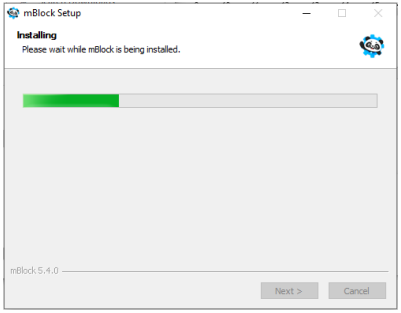
Link: https://mblock.makeblock.com/en-us/download/ @ QR:

Step 2 Download the latest version of mBlock v5 based on the computer operating system.

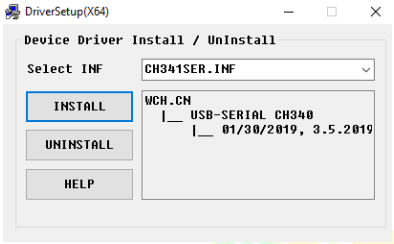


Step 3 Click mBlock v5 on your download location.

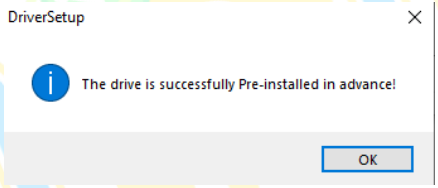
Step 4 Wait until mBlock v5 installation is complete.



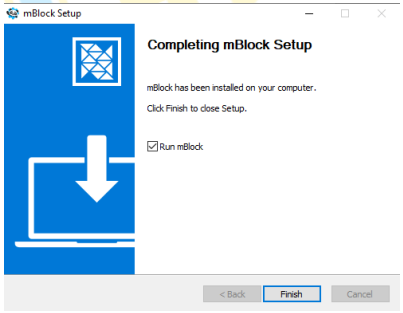
Step 5 Click '*INSTALL*'.



Step 6 Click OK and exit

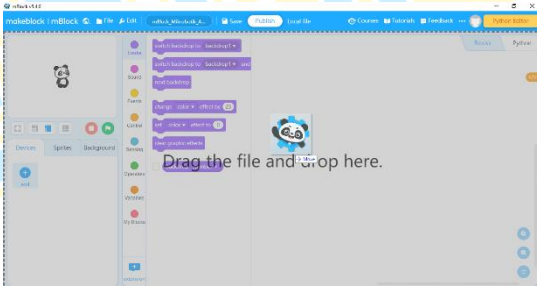


Step 7 Tick "*Run* mBlock".
Click "*Finish*".



Steps for Adding Mikrobotik

Step 1	Mikrobotik software can be obtained from: Link: https://www.microconcept.com.my/stem-robotic/download/
Step 2	Open mBlock v5
Step 3	Go to mikrobotik.mext file and drag into mBlock v5.
Step 4	Now, you can enjoy using mBlock v5!



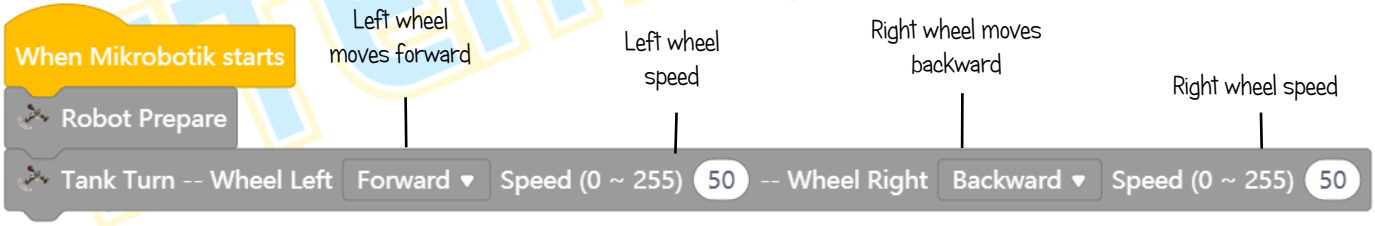
Calibration Process

The calibration process is an important process for the robot to identify between the white line and the black line. The calibration process for this Mikrobotik robot can be done both manually and automatically. This process is done before the robot can follow the line and complete the circuit.

Block Arrangement (Automatic Calibration):

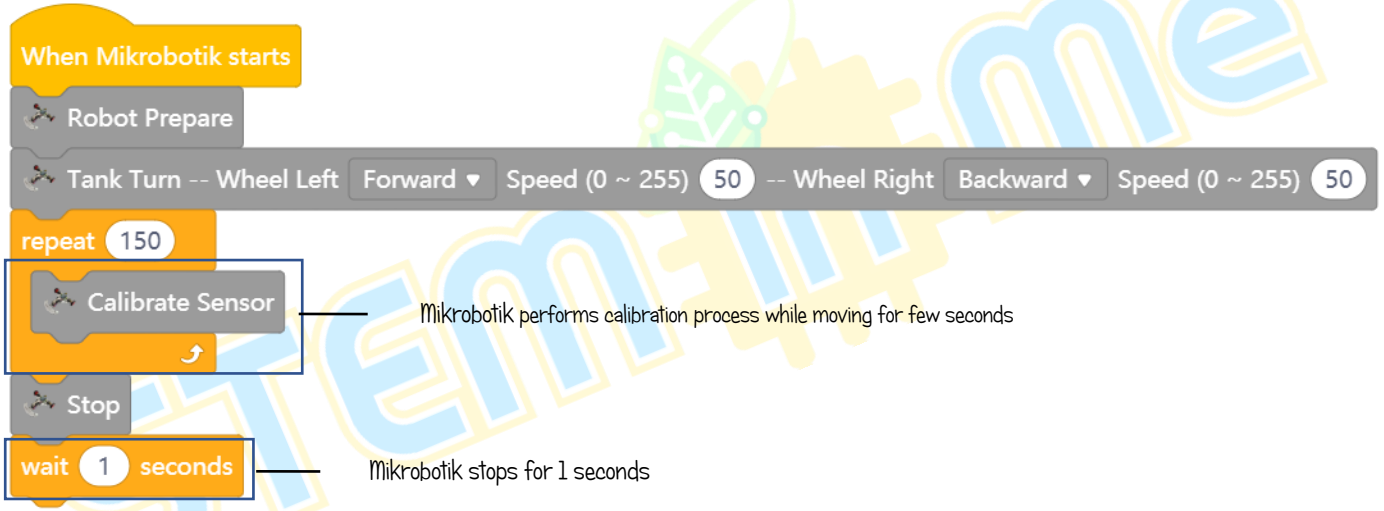
Step 1 Insert block *When Mikrobotik Starts* and combine with block *Prepare*.

Step 2 Next, combine block *Tank Turn (Wheel Left-Forward, Speed*-50, *Wheel Right-Backward, Speed*-50) under *Robot Prepare*.



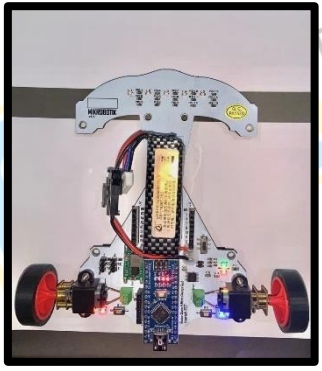
Step 3 Furthermore, combine block *Repeat* with block *Calibrate Sensor*. Combine these blocks with blocks in Step 2.

Step 4 Lastly, drag *Stop* and block *Wait (1 second)* and put under block *Repeat*.

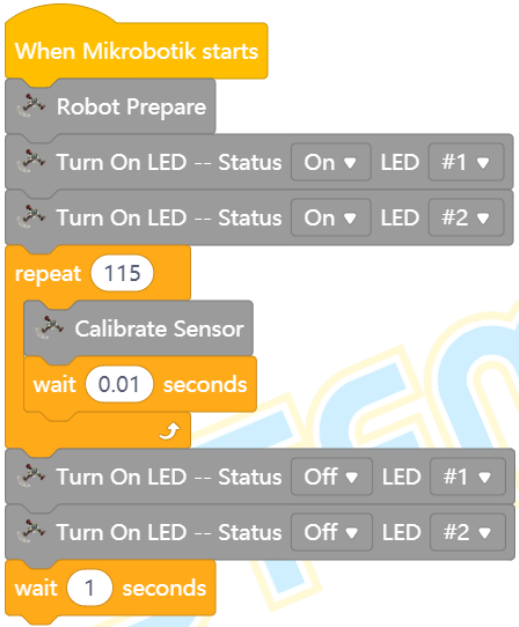


Steps for Automatic Calibration Process

Step 1	Put Mikrobotik on the track. Make sure all sensors starting from TR1 (LED L1) until TR5 (LED L5) were put on black line.
Step 2	Switch on the power switch for Mikrobotik. Red LED1 light and blue LED2 will light up. The robot will automatically rotate to carry out the calibration process.

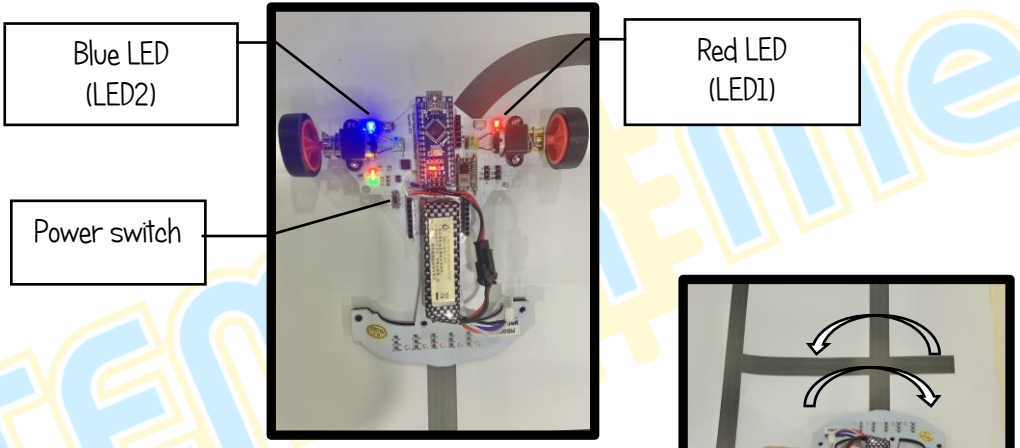


Block Arrangement (Manual Calibration):

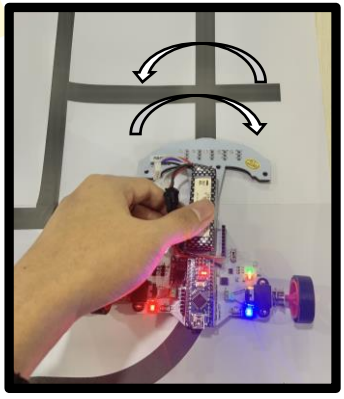


Steps for Manual Calibration Process

Step 1 Switch on Mikrobotik.
LED1 with red colour and LED2 with blue colour will light up.

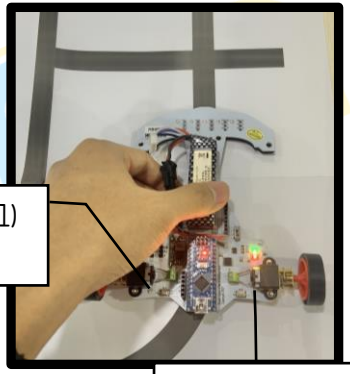


Step 2 Move all sensors starting from sensor labelled with TR1 (LED L1) until TR5 (LED L5) and bring back to TR1 (LED L1).



Step 3	Repeat movement in Step 2 until both LED (LED1 and LED2) light off.

Make sure all the sensors can detect the black line. The LED on the sensors will light up if the sensor detects a black line. For example LED L1 will light up if sensor TR1 detects a black line on the circuit.

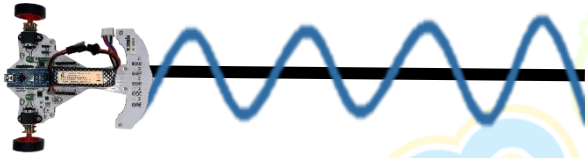
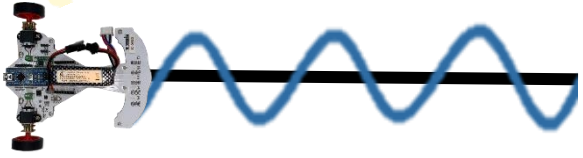


Red LED (LED1) lights off.

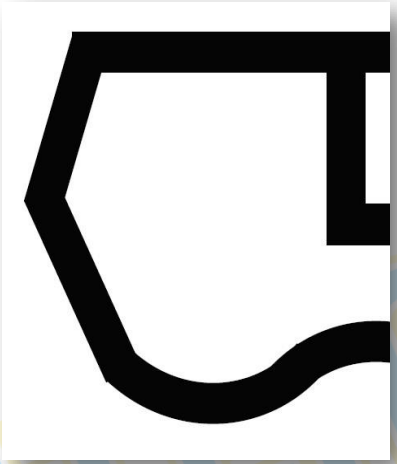
Blue LED (LED2) lights off

Autonomous Robot PID Algorithm

PID algorithm is a control strategy suitable to assist determine the direction and speed of the robot such that it autonomously drive and follows the line as close and fast possible. PID algorithm will ensure the robot does not overshoot from the line track when turning and moves straight along the line.

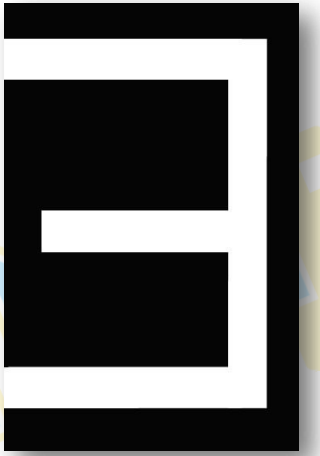
Kp	Kd
High Kp Value  Steers vigorously	High Kd Value  Counter steers early
Low Kp Value  Steers gently	Low Kd Value  Counter steers late

Type of Tracks



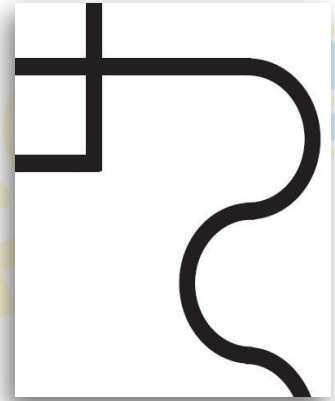
Black Line

(aprox 20mm)



White Line

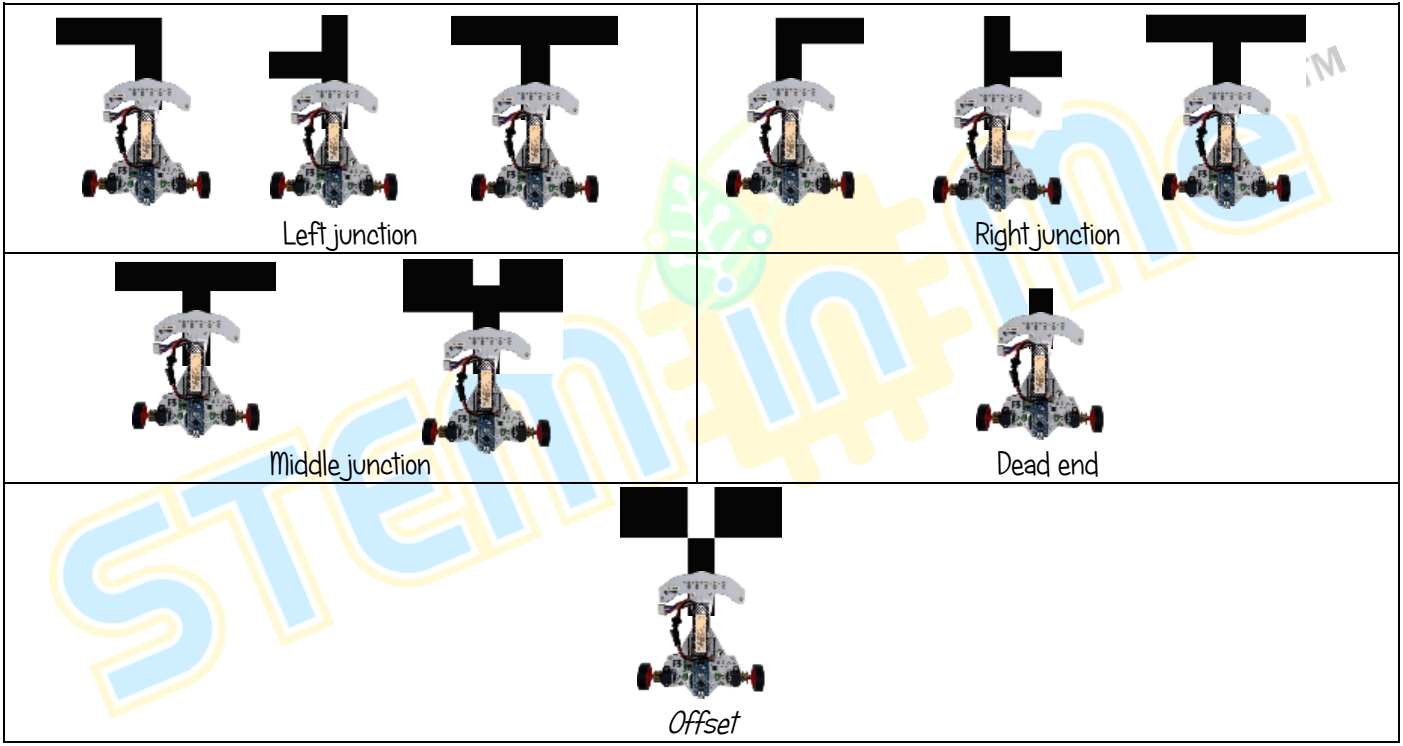
(aprox 20mm)



Black Thin Line

(aprox 10mm)

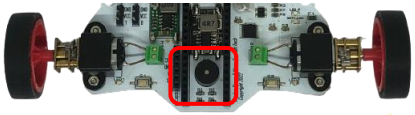
Type of Junctions



Objective 1: Vroom Vroom

The robot will use a buzzer to produce a simple sound. It can only produce one tone at a time. This code block can be used to produce different tones to create an interesting sound pattern.

Introduction to Buzzer



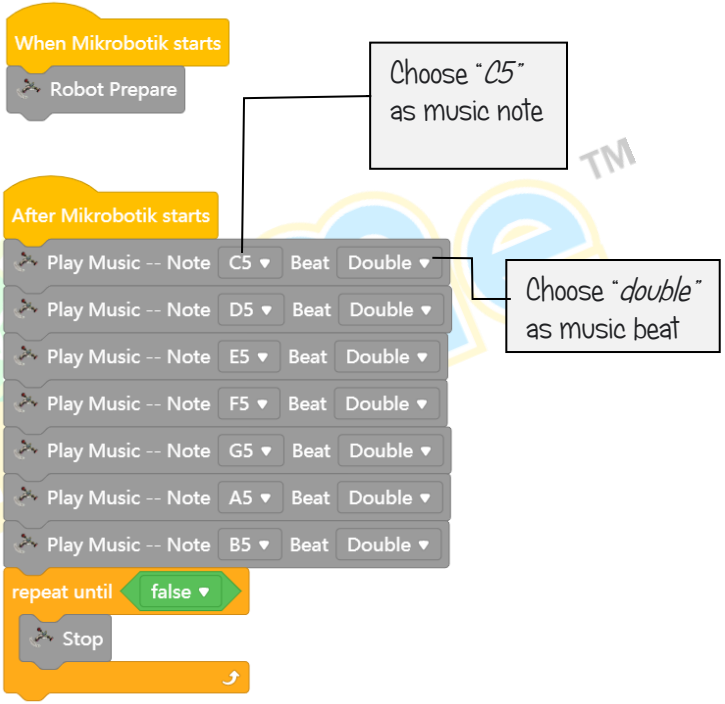
Buzzer is a type of sound device that converts audio models into sound signals. It is usually used for alarms.

Step by Step block arrangement:

Step 1 Combine block *When Mikrobotik starts* with block *Robot Prepare*.

This block is to prepare robot with specific *library* and to configure pin numbers and pot numbers in and out for each sensor and output attached to the robot.

Step 2	Next. combine block *After Mikrobotik starts* with block *Play Music (Note-C5. Beat-Double). (Note-D5. Beat-Double). (Note-E5. Beat-Double). (Note-F5. Beat-Double). (Note-G5. Beat-Double). (Note-A5. Beat-Double). (Note-B5. Beat-Double)*

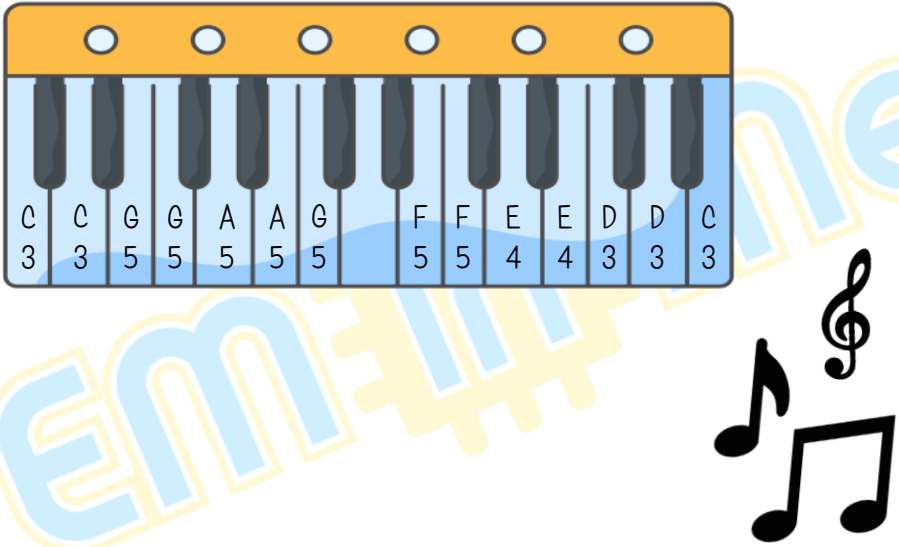


Step 3	Then. combine block *repeat until (false)* with block stop. Combine these blocks with blocks in Step 2.

Step 4	Once the program is uploaded. the robot will produce the sound or tone you have entered.

Challenge!!

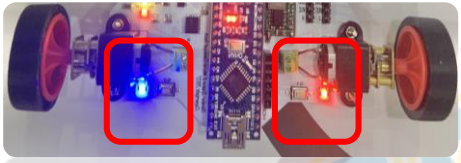
In this challenge. you have to enter the provided musical notes and try to guess the name of the music.



Objective 2: Please Switch On The Lights!

Light-Emitting Diode (LED) on robot used as indicators. LEDs on the robot can be seen at power indicator, low battery indicator, LED1, LED2, Arduino NANO and line sensors.

Introduction to Light-Emitting Diode (LED)



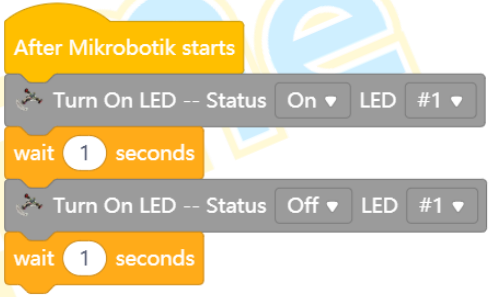
Light-Emitting Diode or LED functions to convert electric current into light and emit light. Used as an application for indicator and light source.

Step by Step block arrangement:

Step 1 Combine block *When Mikrobotik starts* with block *Robot Prepare*.

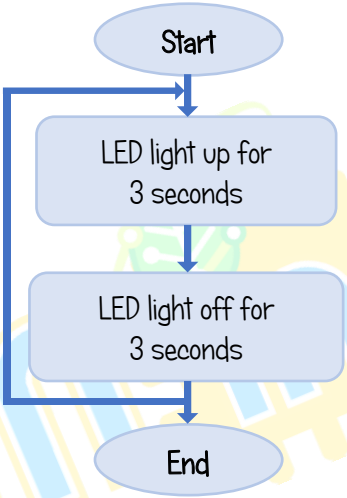
Step 2	Combine block *After Mikrobotik starts* with block *Turn On LED* with choice of *Status On* and LED #1 and block *wait 1 second*. Put the blocks under the block in Step 1. This program will light up the LED.

Step 3	Add another block *Turn On LED* with choice of *Status Off* and LED#1 with block *wait 1 second* and combine with block in Step 2 to switch off the LED.



Step 4	Lastly, upload the program. After the program uploaded, LED 1 will light up in one second and light off in one second. The program will continue to run until the robot is turned off by the user.

Challenge!!

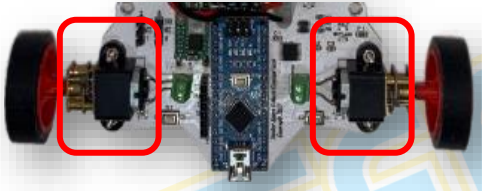


Program above show LED will light up in three second and light off in three second. The program will continue to run until the Mikrobotik is turned off by the user.

Objective 3: Our Adventure Begin (Free Movement)

The robot is moved using the code block "tank turn" to move without following the line. This code block is suitable for solving maze circuits (labyrinth). The robot will move depending on the speed and direction of the left and right motors set by user.

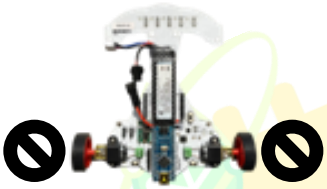
Introduction to Motors



There are two motors on Mikrobotik that can be controlled separately. can rotate clockwise and counterclockwise continuously. These motors can also be used to move or drive the project. The speed and duration can also be set.

Introduction to Basic of Free Movement:

Stop

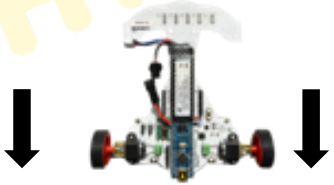


Left motor stops, right motor stops.

Moves forward

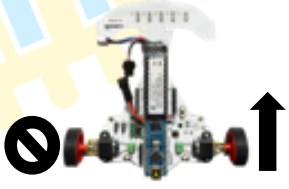
Left motor forward, right motor forward
left motor speed = right motor speed

Moves backward



Left motor backward, right motor backward
left motor speed = right motor speed

Steer to right	Steer to left
	
Left motor forward, right motor forward. Left motor speed > Right motor speed	Left motor forward, right motor forward. Left motor speed < Right motor speed

Sharp steer to right	Sharp steer to left
	
Left motor forwards, right motor stops.	Left motor stop, right motor forwards.

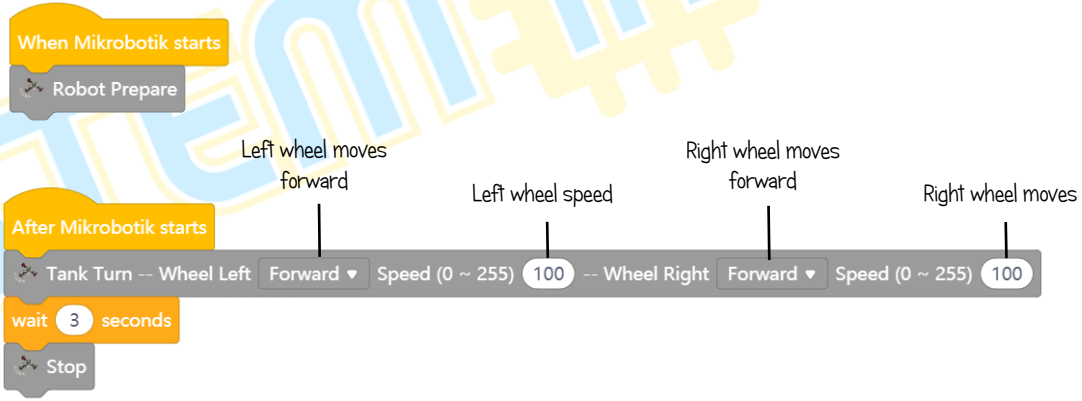
Turn to right	Turn to left
	
Left motor forward, right motor backward left motor speed = right motor speed	Left motor backward, right motor forward left motor speed = right motor speed

Step by Step block arrangement

i) Move forwards

Step 1 Combine block *When Mikrobotik starts* with block *Robot Prepare*.

Step 2 Combine block *After Mikrobotik starts* with block *Tank Turn* (*Wheel Left -Forward. Speed*-100. *Wheel Right-Forward. Speed*-100). block *wait* (*3 seconds*) and block *stop*. Drag those blocks and put it under the blocks in Step 1.
Left motor and right motor will move with the same speed.



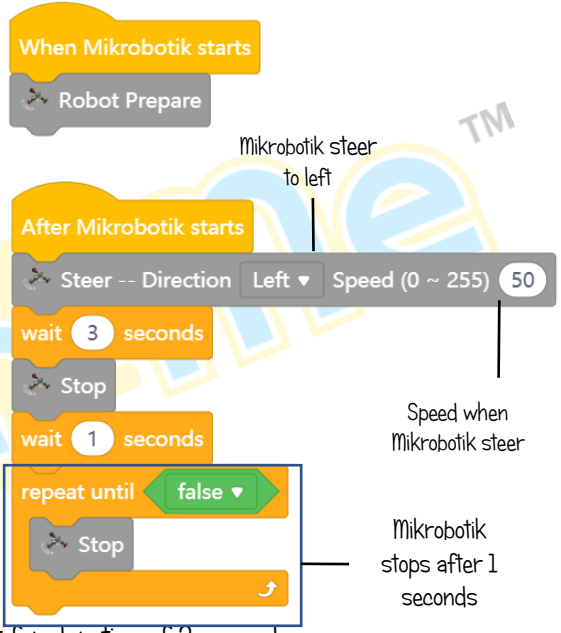
Step 3 Lastly, combine block *wait* block *repeat until (false)* and block *stop* and combine those blocks with blocks in Step 2.

Step 4 After the program uploaded. Mikrobotik will move forwards for duration of 3 seconds.

Step to make the robot move backwards is the same as step to move forwards. You only need to change the direction of the left wheel to backward and the direction of the right wheel to backward.

ii) Steer to left

Step 1	Combine block *When Mikrobotik starts* with block *Robot Prepare*.
Step 2	Combine block *After Mikrobotik starts* with block *Steer (Direction –Left, Speed–50)*. Then, add block *wait (3 seconds)* and block *stop*. Left motor will stop and right motor will move forwards with the set up speed.
Step 3	Lastly, combine block *wait (1 second), repeat until (false)* and block *stop* and combine those blocks with blocks in Step 2.
Step 4	After the program uploaded, Mikrobotik will steer to left for duration of 3 seconds.

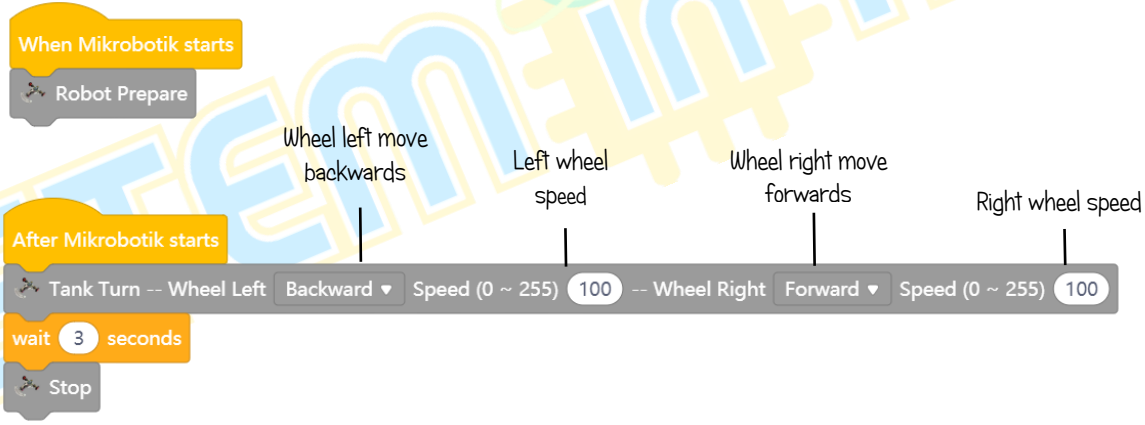


Step for steer to the right is similar to the step for steer to the left. You just need to change the direction to right.

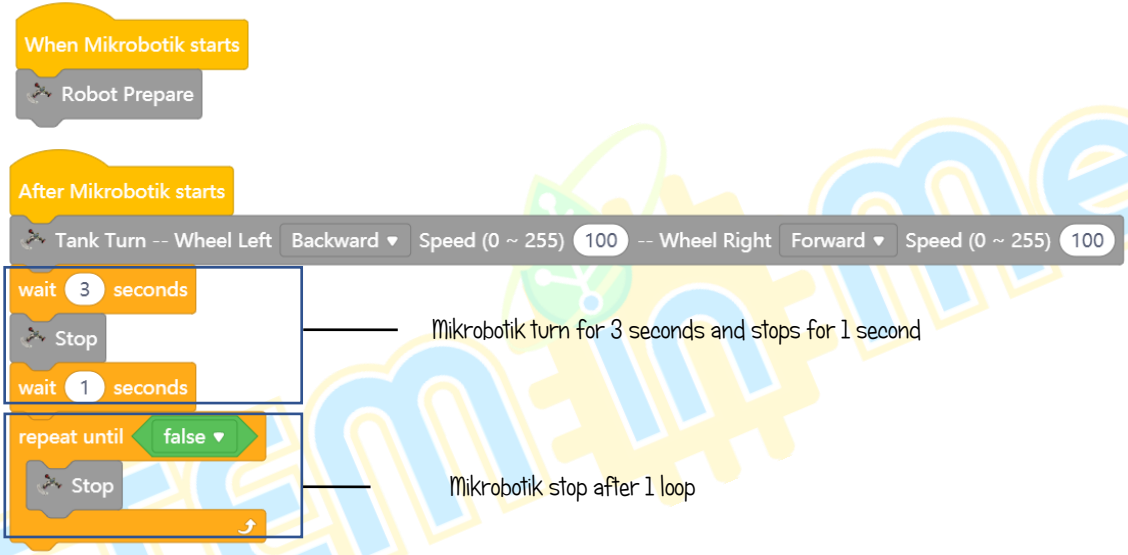
iii) Turns left

Step 1 Combine block *When Mikrobotik starts* with block *Robot Prepare*.

Step 2 Combine block *After Mikrobotik starts* with block *Tank Turn (Wheel Left -Backward. Speed*-100. *Wheel Right-Forward. Speed*-100). block *wait (3 seconds)* and block *stop*. Drag those blocks to under block in Step 1. The left motor will move backward and the right motor will move forward with the same speed.



Step 3 Lastly, combine block *wait (1 second)*, *repeat until (false)* and block *stop*. Then, combine those blocks with blocks in Step 2.

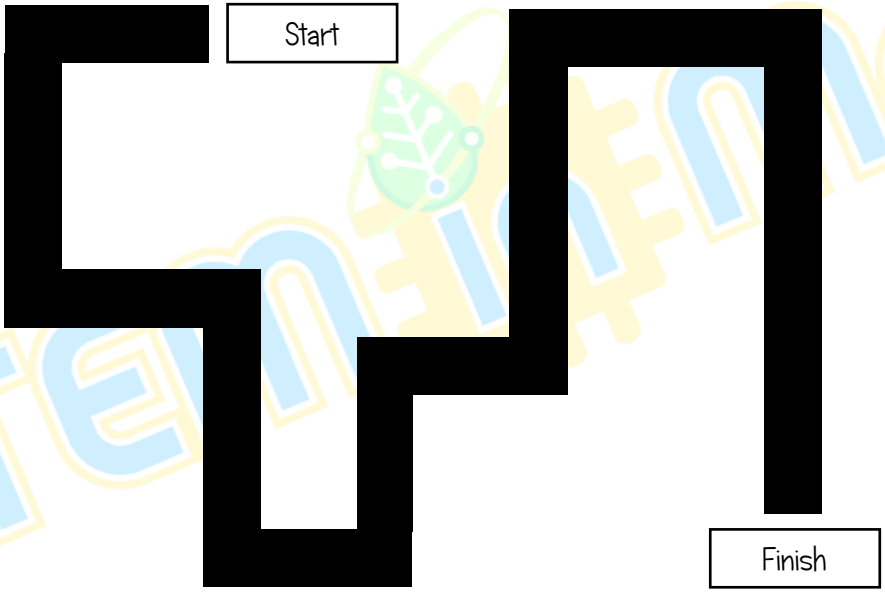


Step 4 After program uploaded. Mikrobotik turns left for 3 seconds and stops.

Step for turn to the right is similar to the step for turn to the left. You just need to change the wheel left direction to forward and wheel left direction to backward.

Challenge!!

In this Challenge. you need to ensure that Mikrobotik moves along the path that has been prepared by applying the knowledge that has been learned.



Objective 4: Let's Follow The Line!

The robot will follow the line (Black or White) continuously. The robot will always move even if it meets a left or right junction.

Introduction to Line Detector

The line detector will emit infrared light and detect black or white surfaces. The analogue reading value will be high if a black surface is detected while the analogue reading value will be low when a white surface is detected.

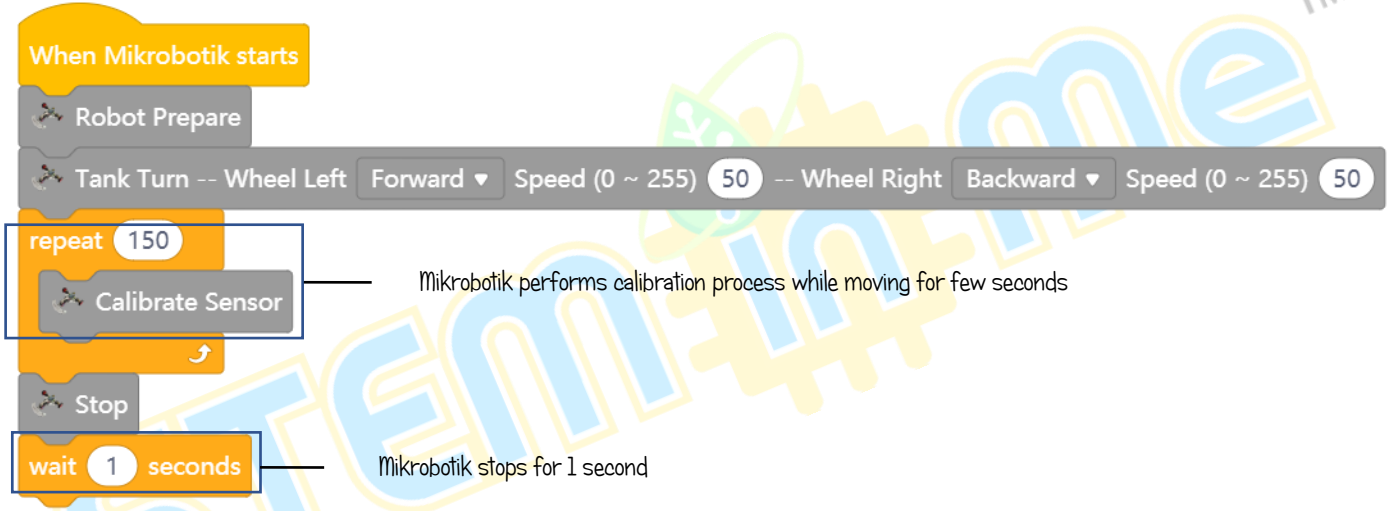
Introduction to Line Tracer Time and its Mechanism

Line Tracer Time used to make Mikrobotik follow along line with Black or White colour until it reach maximum time period (in ms).

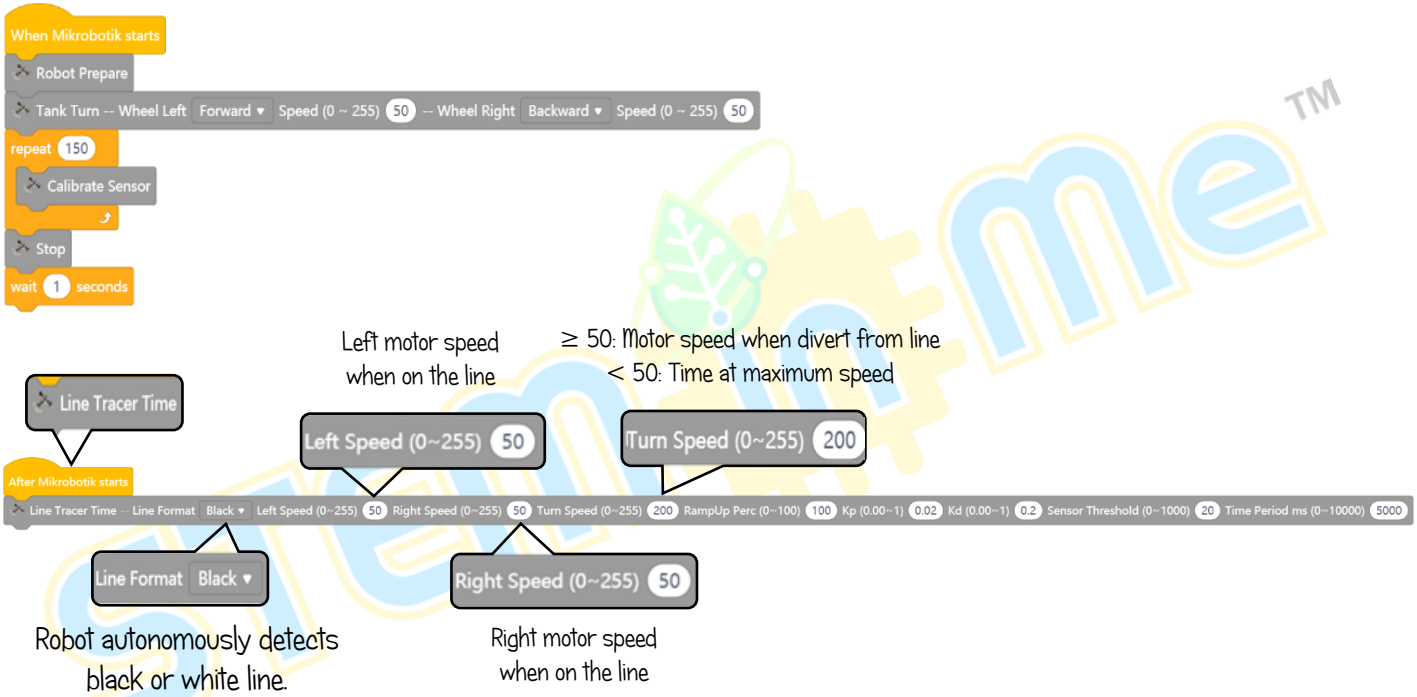
When Mikrobotik reaches the maximum time period. Mikrobotik will stop. Mikrobotik will move continuously without making turn when meeting left junction. right junction and middle junction.

Step by Step block arrangement:

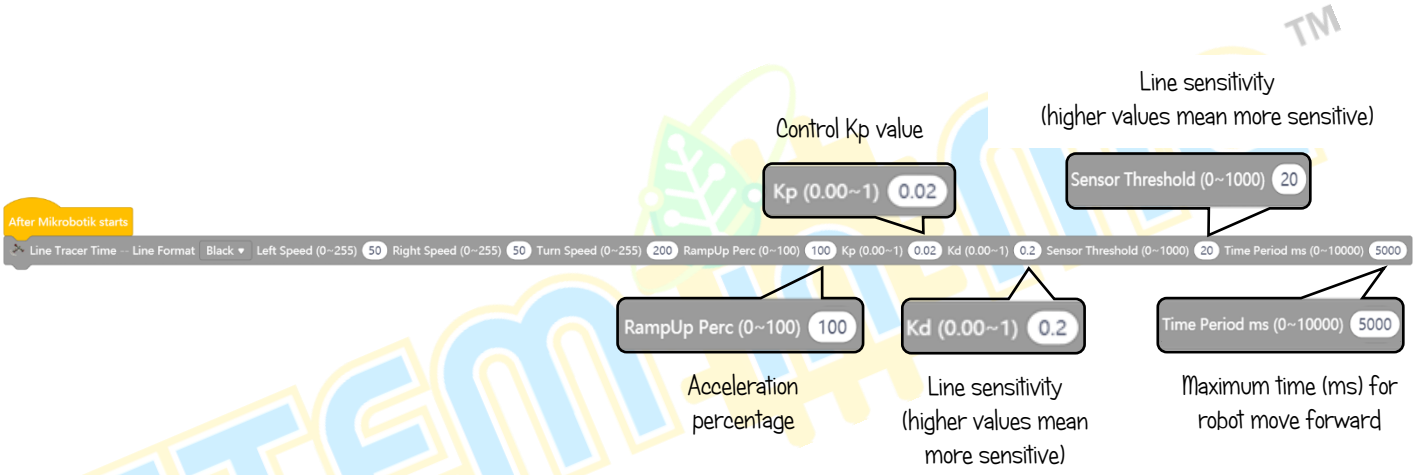
Step 1 Prepare the arrangement blocks for automatic calibration.



Step 2 Then, insert block *After Mikrobotik Starts* and combine with block *Line Tracer Time*.



Continuity

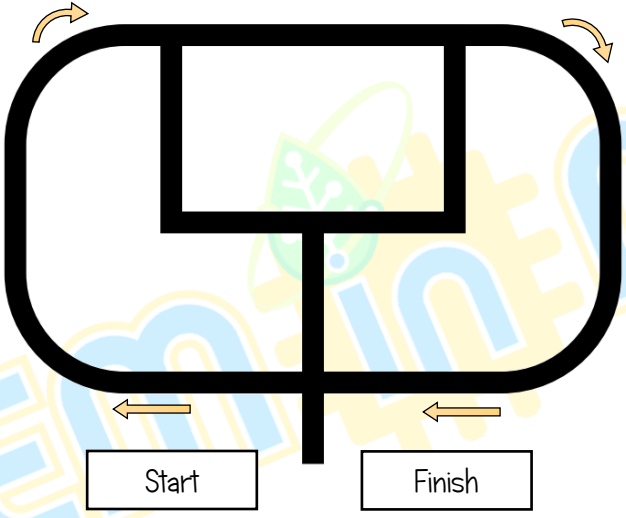


Step 3	Combine the "repeat until (false)" block and the "stop" block. Then. integrate these blocks with the block in Step 2.

Step 4	After uploading the code. Mikrobotik will start moving forward temporarily. Perform the calibration process on the line sensor. After that. Mikrobotik will follow the line of either Black or White until it reaches the maximum time period (in ms).

Challenge!!

Apply *Line Tracer Time* to solve the track below.



Objective 5: What To Do When Meeting Junction?

Robot will move autonomously and can decide whether to turn left. turn right or stop at the junction. The technique used to know as *Steer Turn Method*.

Introduction to *Path Finder* and its Mechanism

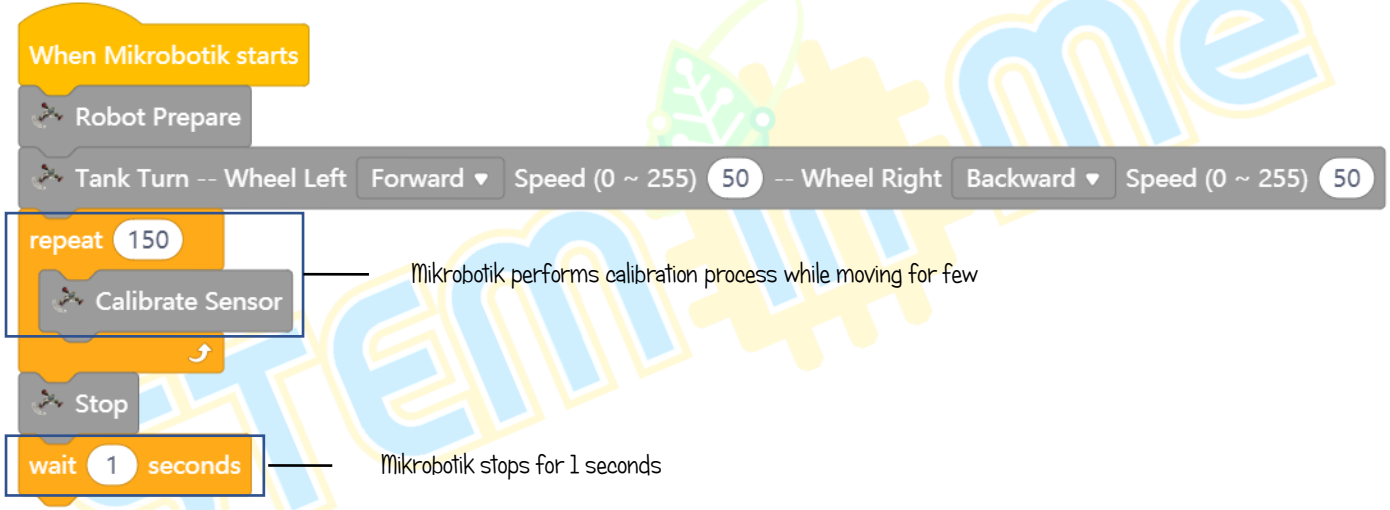
Path Finder is used to move the Mikrobotik autonomously follow over a white or black line until the Mikrobotik finds a junction (right or left or middle or dead end or offset).

At the junction. Mikrobotik will act to turn (left or right or stop) for a set period of time or until the robot finds the next line and will stop.

Robot will turn by using *Steer Turn Method*.

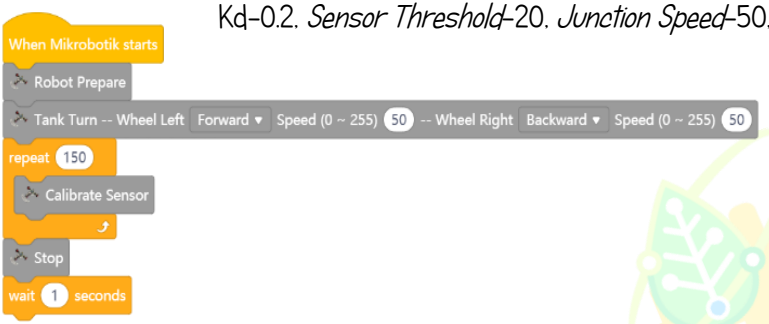
Step by Step Block Arrangement

Step 1 Prepare the blocks arrangement for automatic calibration.



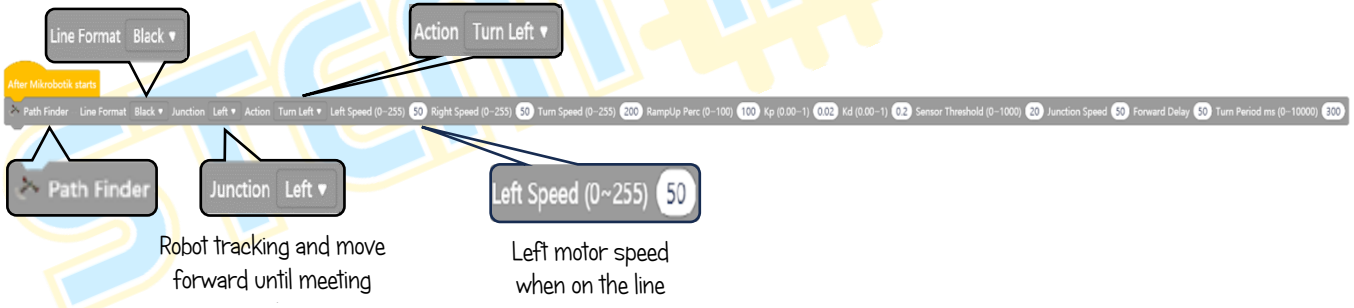
Step 2

Lastly, combine block *After Mikrobotik Starts* and block *Path Finder (Line Format-Black. Junction-Left. Action-Turn Left. Left Speed*-50. *Right Speed*-50. *Turn Speed*-200. *RampUp Perc*-100. Kp-0.02. Kd-0.2. *Sensor Threshold*-20. *Junction Speed*-50. *Forward Delay*-50. *Turn Period ms*-300).



Robot autonomously detects black or white line.

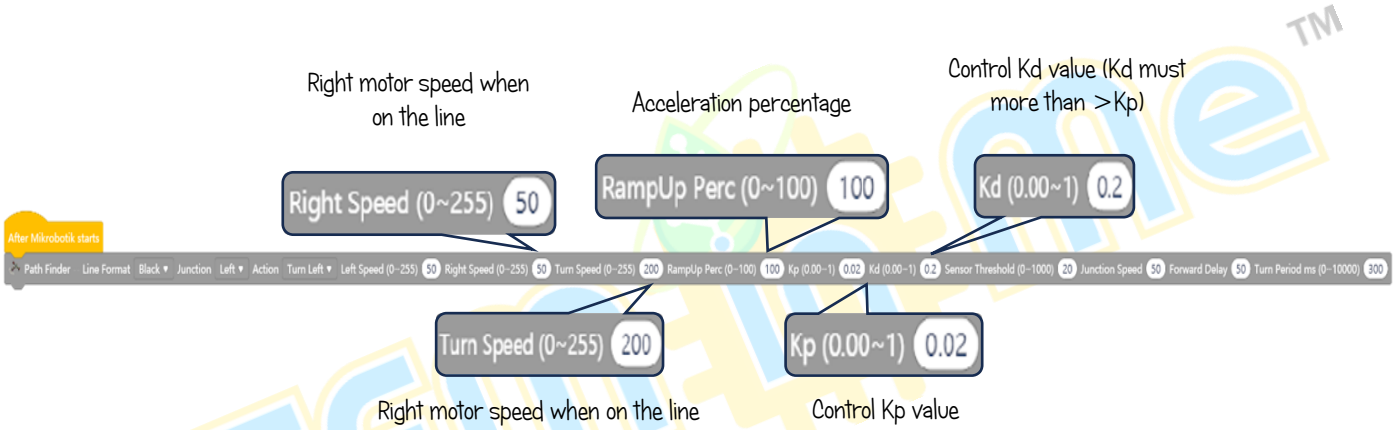
Robot action when meeting junction



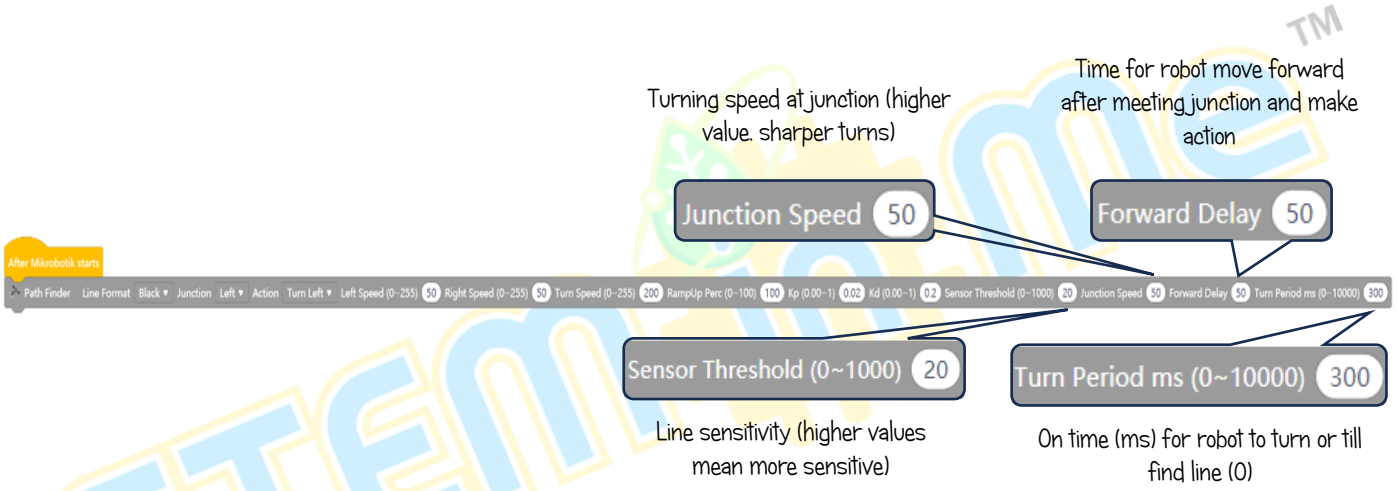
Robot tracking and move forward until meeting

Left motor speed when on the line

Continuity



Continuity



Step 3

Combine the "repeat until (false)" block and the "stop" block. Then. integrate these blocks with the block in Step 2.

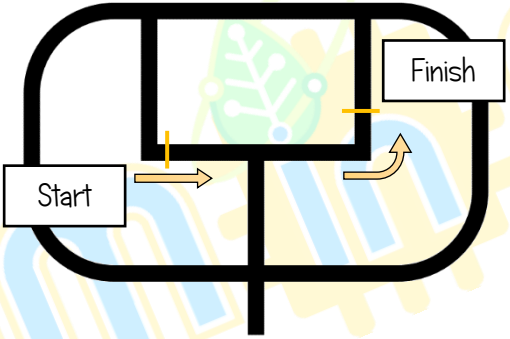
Microbotics stops after 1 cycle

Step 4

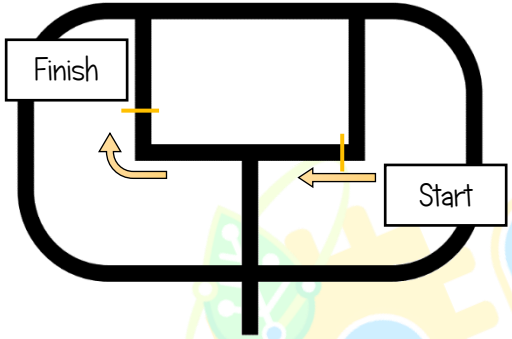
After uploading the code. turn on the Mikrobotik switch and perform the calibration process. After that. Mikrobotik will follow the black line and if the robot meets a left junction. Mikrobotik will move forward and then turn to enter the left junction until Mikrobotik meets another line.

Challenge!!

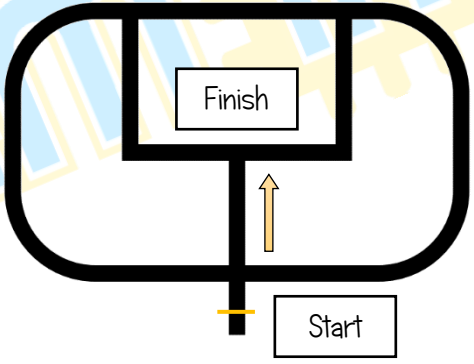
i) *Path Finder* Left Junction. steer left at left junction.



ii) *Path Finder* Right Junction. steer right at right junction.



iii) *Path Finder* Middle Junction. stop.



Objective 6: What Else Can Be Done When Meeting Junction?

Robot will move autonomously and can decide whether to turn left. turn right or stop at the intersection. The technique used known as *Tank Turn Method.*

Introduction to *Path Finder Tank* and its Mechanism

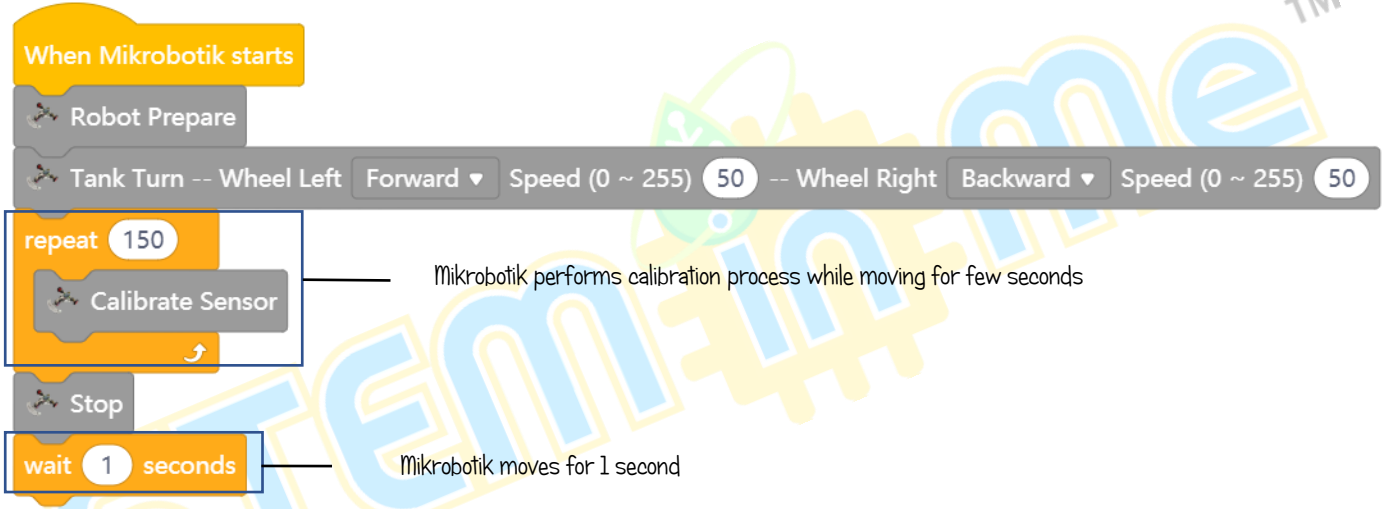
Mikrobotik travel autonomously on lines (Black or White or Thin Black or Thin White) until meet an intersection (Left or Right or Middle or Dead End or Offset).

At the junction. Mikrobotik will act (Turn left or Turn right or Stop) for at least the Minimum Turn Period *(Min Turn Period)* and continue turning until it detects the line and stops.

Mikrobotik will turn by using *Tank Turn Method.*

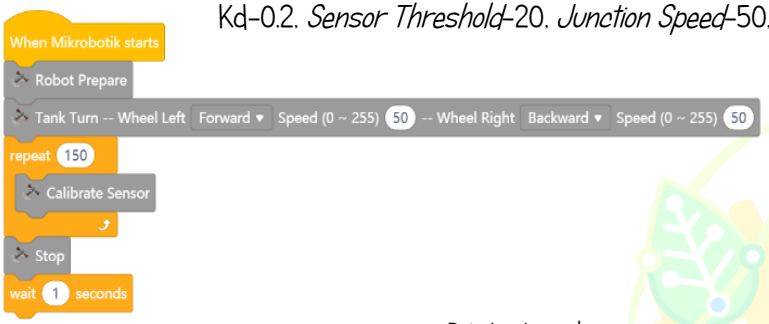
Step by Step block arrangement:

Step 1 Prepare the blocks arrangement for automatic calibration.



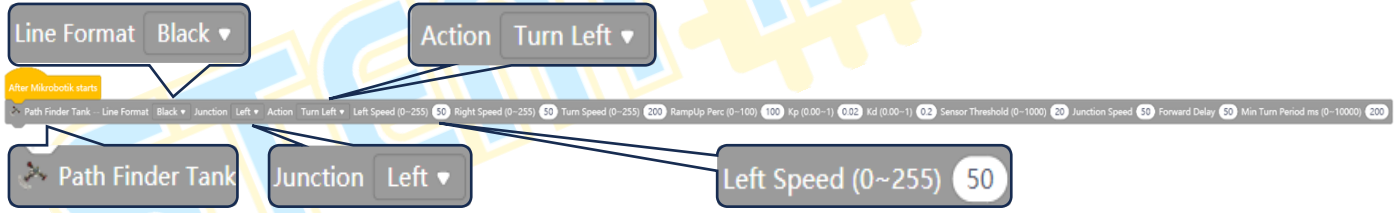
Step 2

Combine block *After Mikrobotik starts* with block *Path Finder Tank (Line Format- Black. Junction- Right. Action-Turn Left. Left Speed*-50. *Right Speed*-50. *Turn Speed*-200. *RampUp Perc*-100. Kp-0.02. Kd-0.2. *Sensor Threshold*-20. *Junction Speed*-50. *Forward Delay*-50. *Min Turn Period ms*-200).



Robot autonomously detects black or white line.

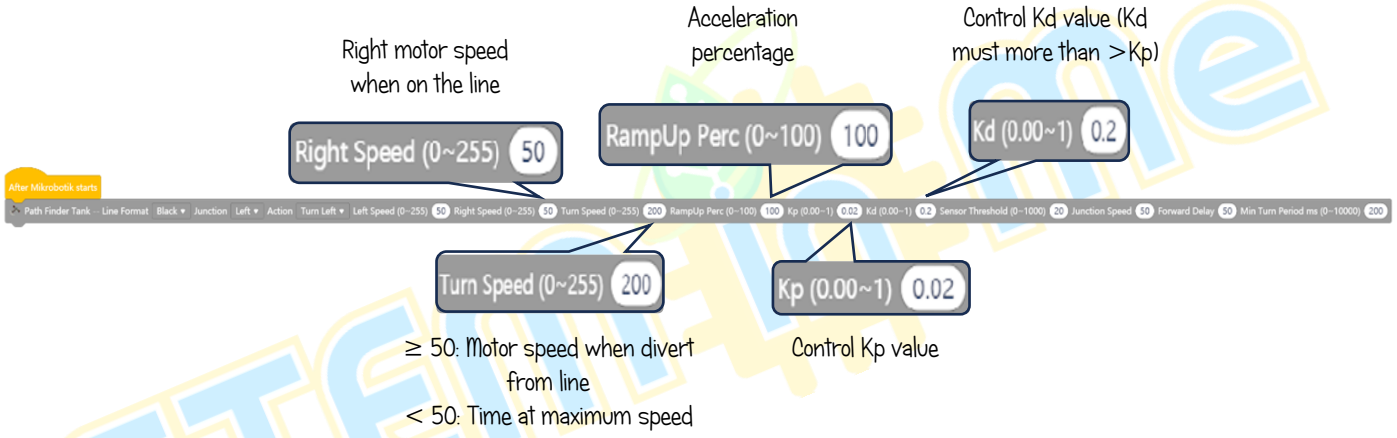
Robot action when meeting junction



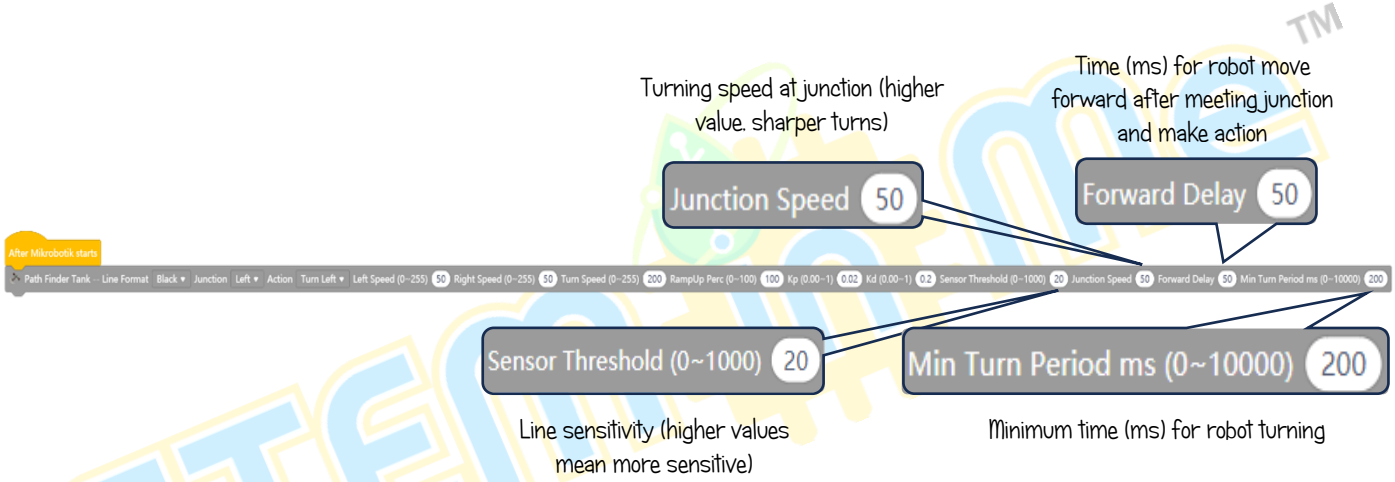
Robot tracking and move forward until meeting junction

Left motor speed when on the line

Continuity



Continuity



Step 3

Combine the "repeat until (false)" block and the "stop" block. Then. integrate these blocks with the block in Step 2.

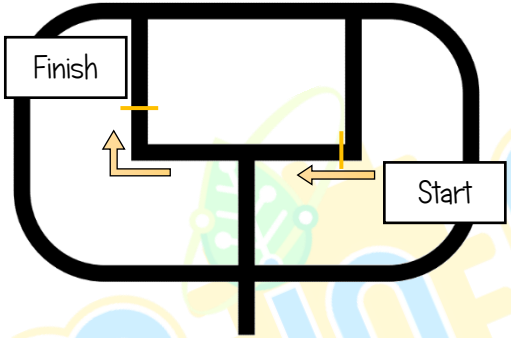
Microbotics stops after 1 cycle

Step 4

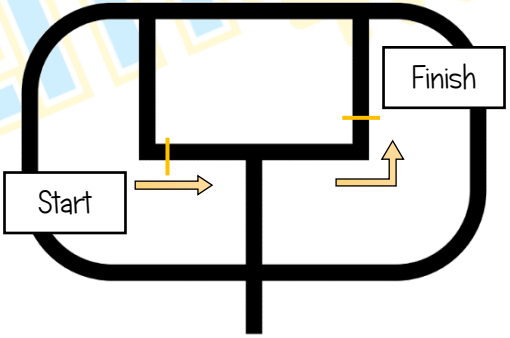
After uploading the code. turn on the Mikrobotik switch and perform the calibration process.
After that. Mikrobotik will follow the black line and if the robot finds a left junction. Mikrobotik will move forward and then turn for at least the Minimum Turn Period *(Min Turn Period)* and continue turning until it detects the line and stops.

Challenge!!

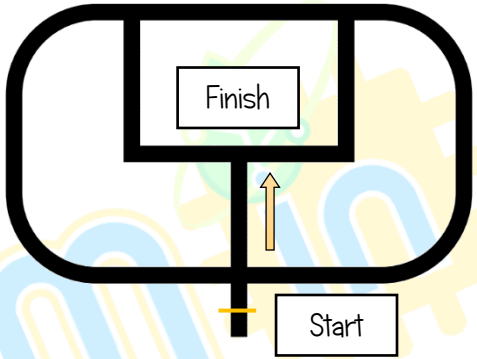
i) *Path Finder Tank* Right Junction, turn at right junction



ii) *Path Finder Tank* Left Junction, turn at left junction



iii) *Path Finder Tank* Middle Junction. stop.



Objective 7: Wrong way? Make U-turn

Mikrobotik can make a U-turn on the line it passes through 180 degrees on its axis and turn left or right during the Minimum Turn Duration (Min Turn Period) and continue until it meets the line (Black or White).

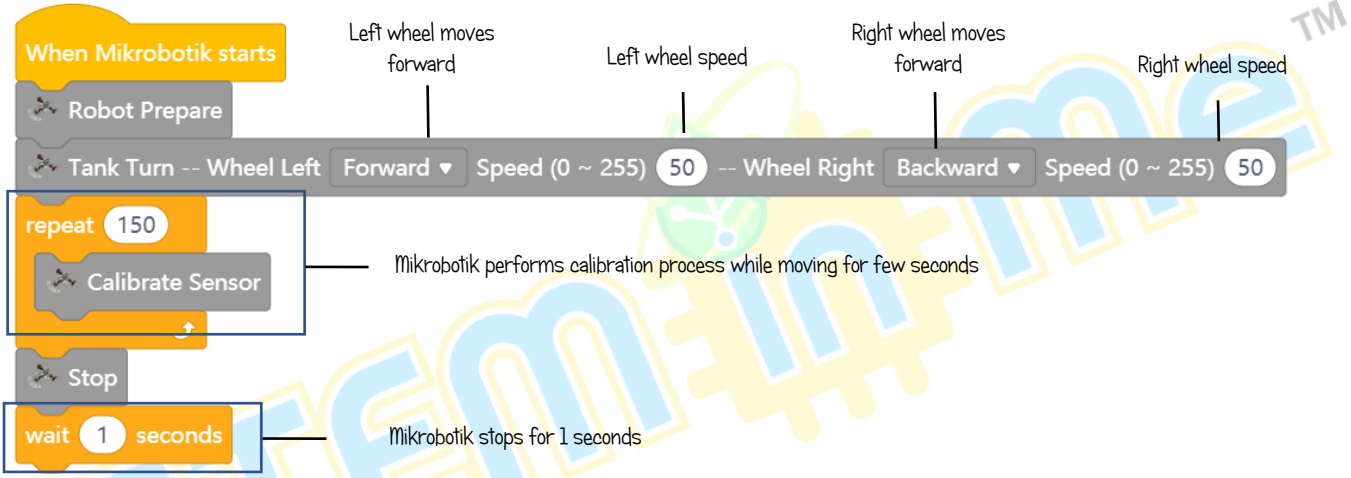
Introduction to *Turn At Centre* and its Mechanism

Mikrobotik will make a tank turn in the direction (left or right) for the Minimum Turn Duration (Min Turn Period) until the robot finds the line and finally stops.

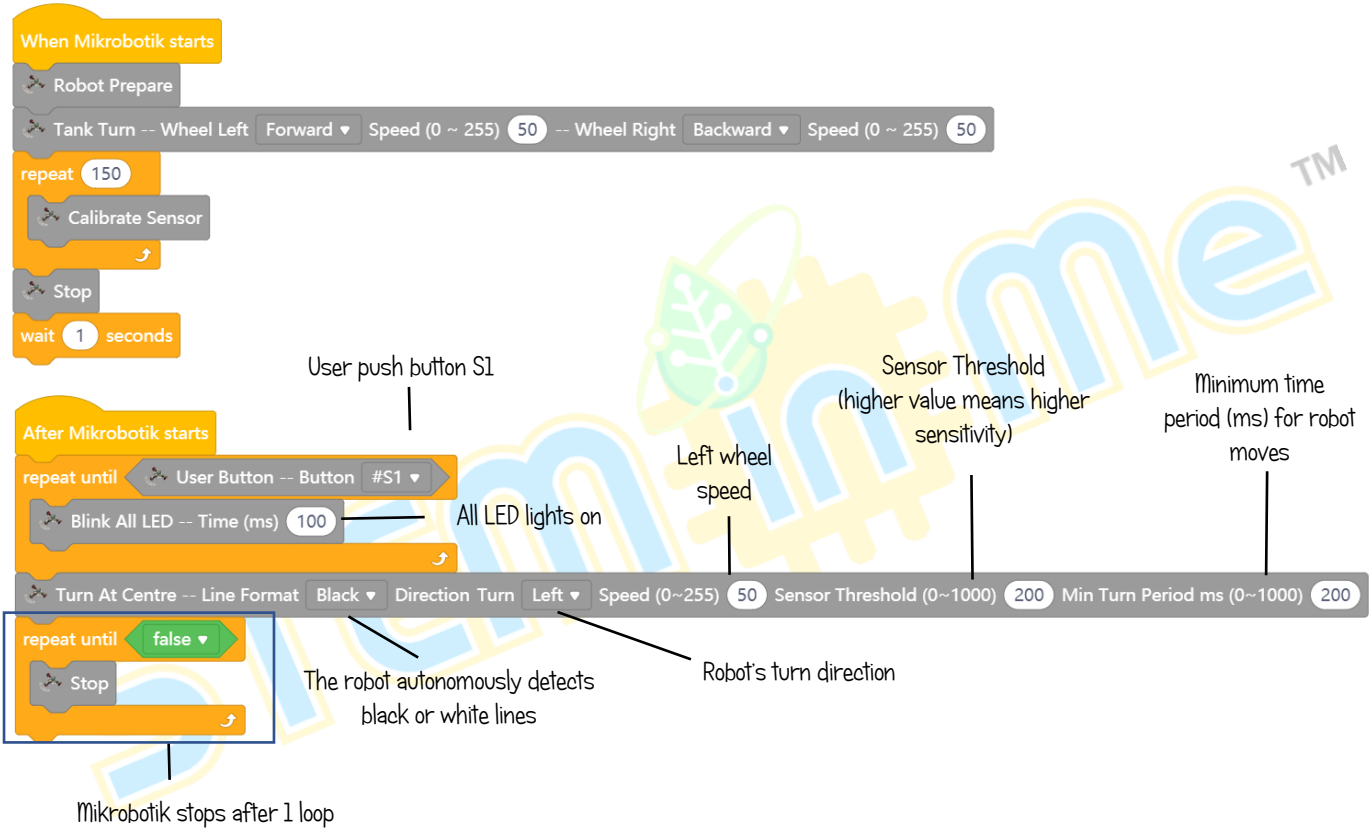
This technique is useful for making U-turns.

Step by Step blocks arrangement:

Step 1 Prepare the arrangement blocks for automatic calibration.



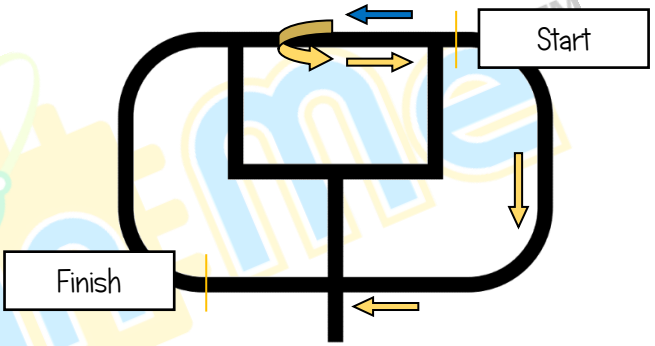
Step 2 Combine block *Find Lind (Line Format- Black. Direction-Forward. Left Speed*-100. *Right Speed*-100. *RampUp Perc*-100. *Sensor Threshold*-20. *Forward Delay*-0) with block *wait (1 second).* Combine those blocks with blocks in Step 4.



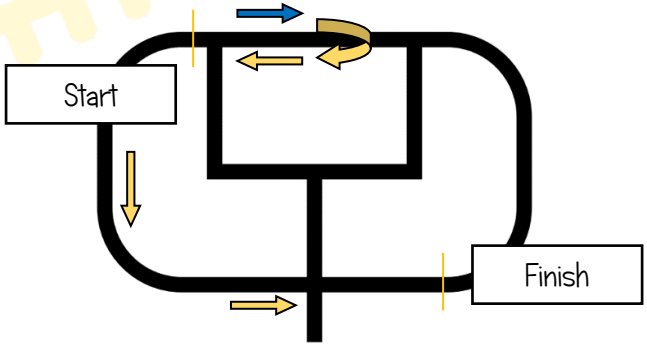
Step 3	After uploading the code. turn on the Mikrobotik switch and perform the calibration process. After that. Mikrobotik will make a U-turn according to the set direction and will stop after detect the black line.

Challenge!!

i) U-turn at the middle. left direction and move forward.
(blue arrow to yellow arrow)



ii) U-turn at the middle. left direction and move forward.
(blue arrow to yellow arrow)



Objective 8: Let's Control Mikrobotik

Bluetooth is a short distance wireless technology used or data exchange between fixed and mobile devices in close range. Besides, it can build private network area. Bluetooth allows Mikrobotik to exchange the desired data with other devices directly.

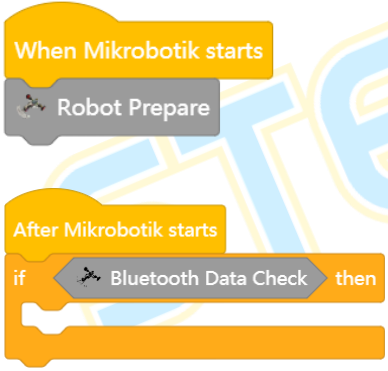
Introduction to Bluetooth and its Mechanism

Mikrobotik can be control in close range using the Bluetooth approach as it can be find and control easily. The Bluetooth module inserted into the port provided. This Bluetooth module contains 4 pins which are RXD, TXD, GND, and VCC.

Step by Step block arrangement:

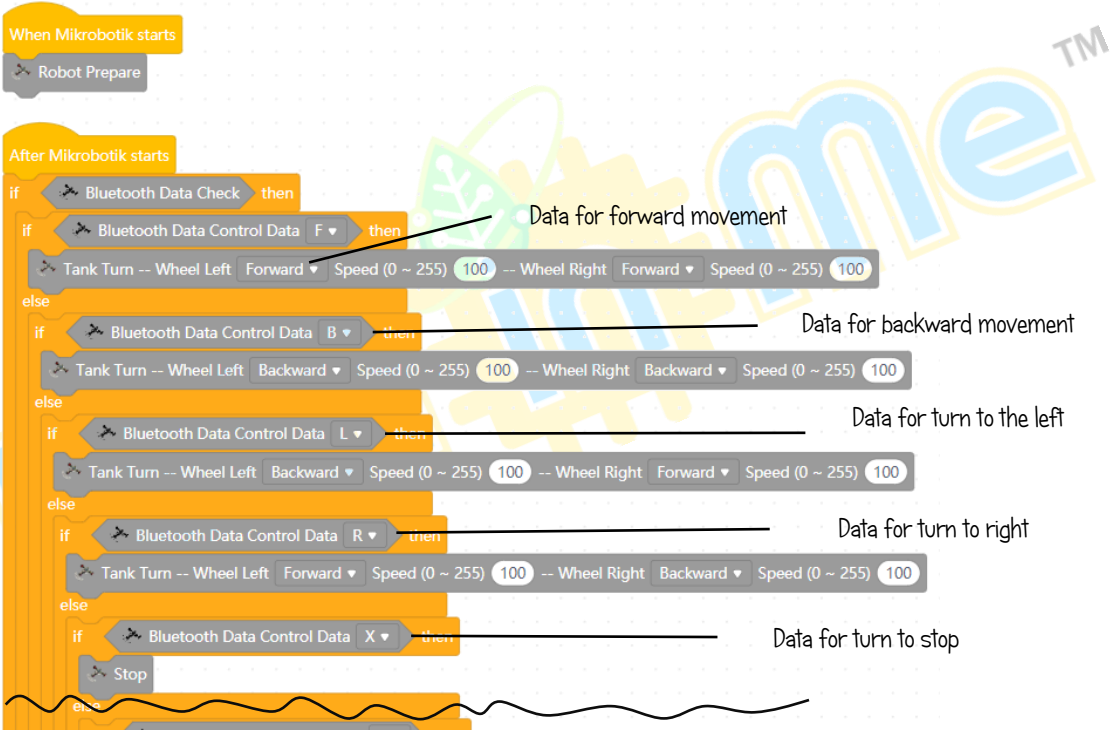
Step 1	Insert block *When Mikrobotik Starts* and combine with block *Robot Prepare*

Step 2	Combine block *After Mikrobotik starts* with block *if* after combined with block *Bluetooth Data Check*. Put those blocks under the block in Step 1.



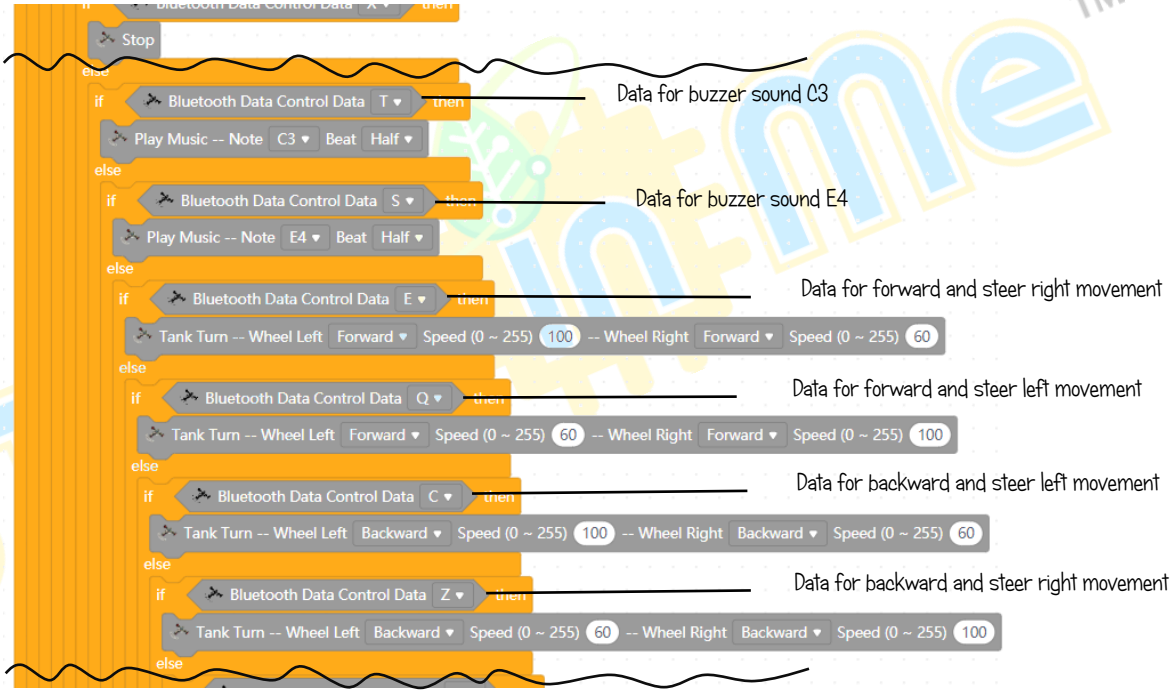
Step 3

Under the block *After Mikrobotik starts*, combine 5 blocks *Bluetooth Data Control Data (F, B, L, R, X)* with 5 blocks *if* and under the block *then* combine with 5 blocks *Tank Turn* to get forward, backward, turn to left, turn to right and stop movement.



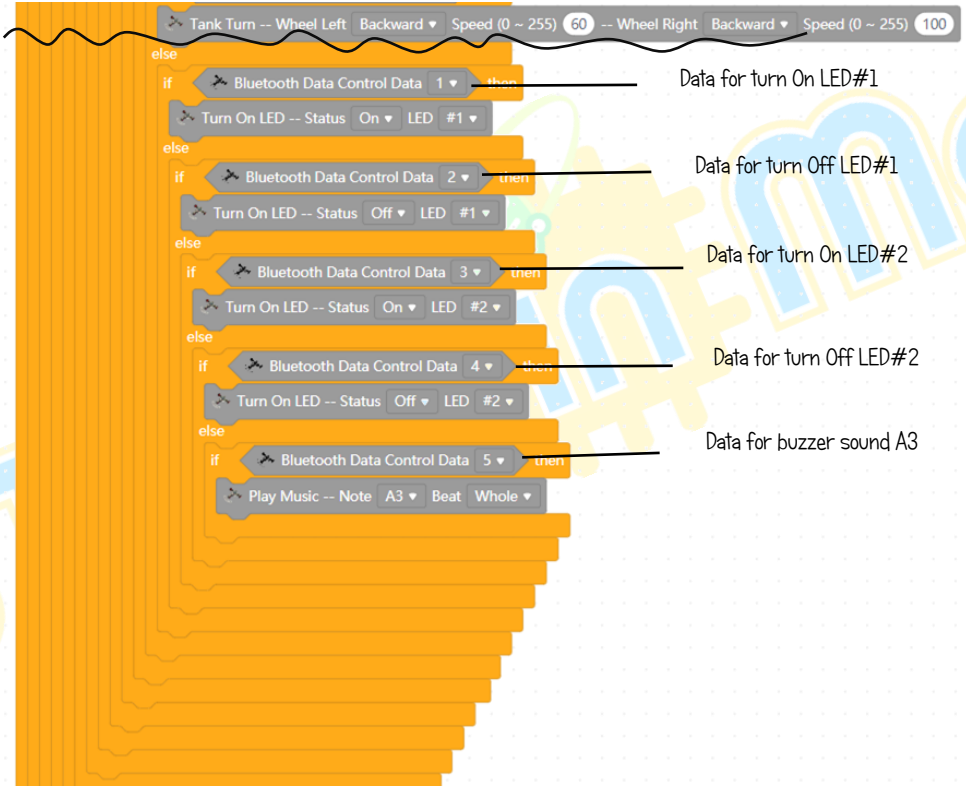
Step 4

For the next block. combine 6 blocks *Bluetooth Data Control Data (T. S. E. Q. C. Z)* with 6 blocks *if* and under the block *then* combine with 2 blocks *Play Music (Note-C3. Beat Half)*5 and 4 blocks *Tank Turn* to get forward and steer right. forward and steer left. backward and steer left. backward and steer right movement.



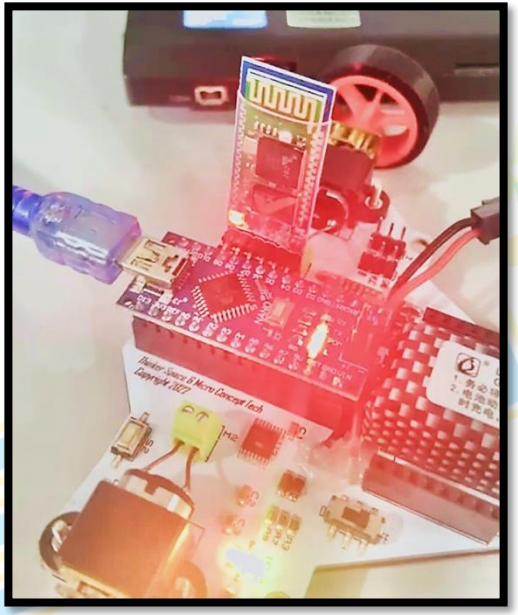
Step 5

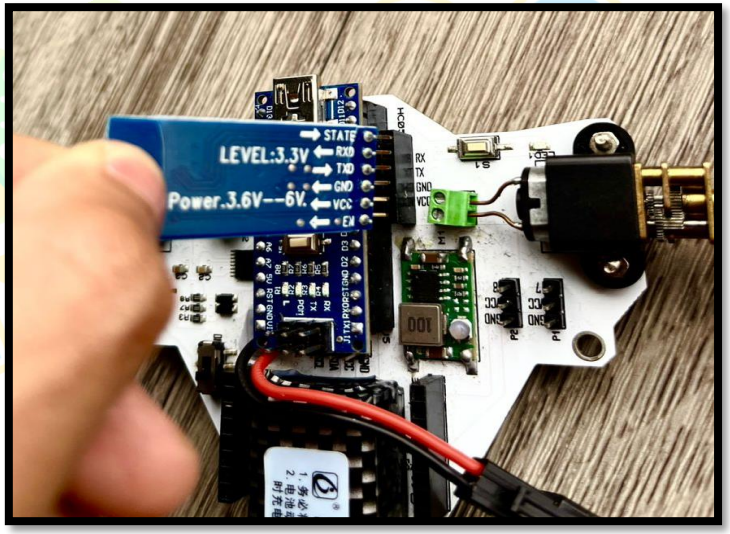
For the next block, combine 5 blocks *Bluetooth Data Control Data (1, 2, 3, 4, 5)* with 5 blocks *if* and under the block *then* combine with 2 blocks *Turn On LED (#1 On, #1 Off, #2 On, #2 Off)* and 1 block *Play Music (Note-A3, Beat Whole)*.



Step 6

After uploading the code. pair the Bluetooth module on the Mikrobotik and match it with the device. Mikrobotik is ready to be controlled by the device. Make sure all Bluetooth pins are connected to the Bluetooth port (RXD-RX. TXD-TX. GND-GND. VCC-VCC)



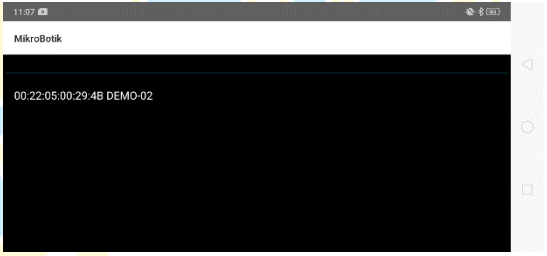


Mikrobotik Mobile Apps

Step 1 Download application from:
https://www.microconcept.com.my/stem-robotic/download/

MIKROBOTIK

Step 2 Open application and click on "Bluetooth connection". Choose based on the number of Bluetooth.

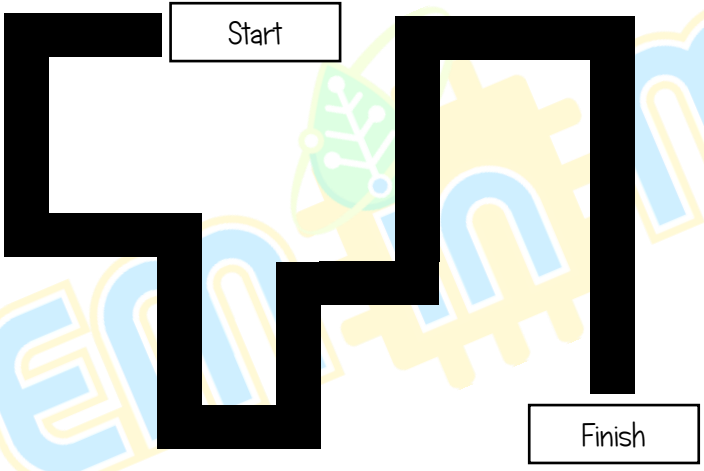


Step 3 Make sure "Connected" displayed. Now Mikrobotik can be controlled in free movement.

MICRO CONCEPT TECH

Challenge!!

In this challenge. you need to make sure that Mikrobotik moves along the path provided by using a device that has been paired with a Bluetooth module on Mikrobotik.



Objective 9: We Need Area Patrol!

Sometimes a robot needs to use more than one block to complete a task such as "area patrol robot". To patrol an area, the robot needs to move along a line at varying speeds and for a certain distance or time. In addition, while following the line, the robot has to make a turn in the opposite direction.

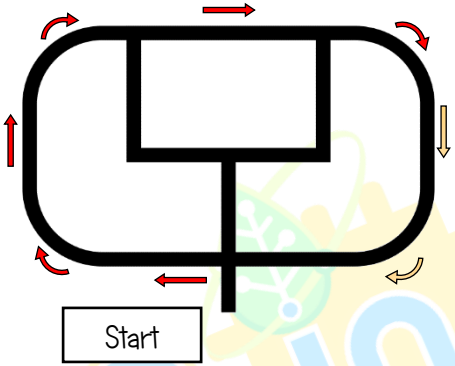
Introduction to Movement and Its Mechanisms

The technique used is to combine several *Line Tracer Time* blocks and *Turn at Centre* blocks.

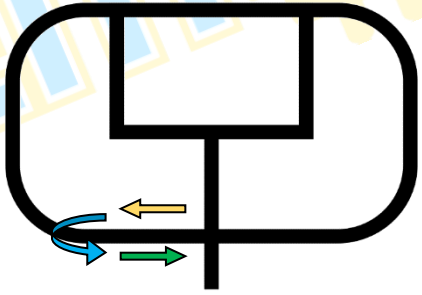
The robot moves autonomously following the line using the *Line Tracer Time* block with high speed and then with low speed for a certain time. After finishing moving, the robot makes a turn in the opposite direction using the *Turn at Centre* block. Finally the robot moves again autonomously by using the *Line Tracer Time* block with high speed.

Here is a sketch of the movement of the "area patrol robot" with a set time and speed and make a turn to complete the task.

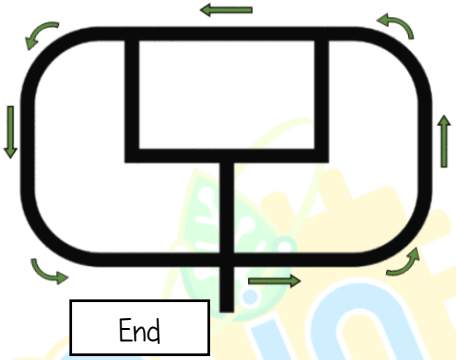
i) The robot moves autonomously using *Line Tracer Time* with high speed for 3 seconds (red arrow) and then with low speed for 3 seconds (yellow arrow).



ii) The robot makes a turn in the middle. towards the left. (yellow arrow direction to green arrow) using *Turn At Centre*.

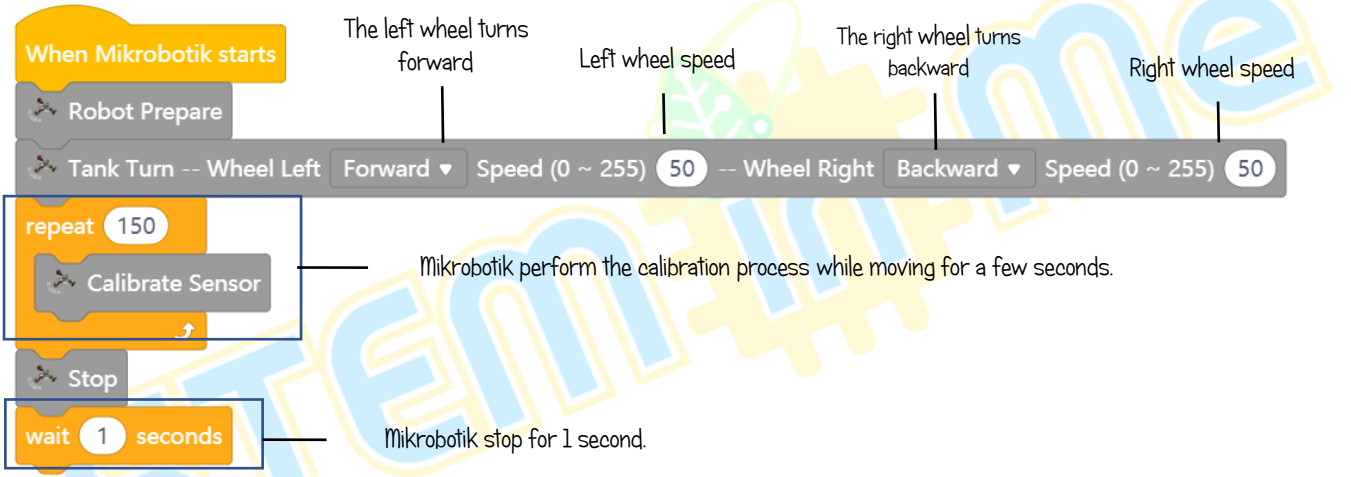


i) The robot moves autonomously to the end point using *Line Tracer Time* at high speed for 4 seconds.



Step by Step Block Arrangement

Step 1 Set up an automatic calibration block arrangement.



Step 2 Combine the *After Mikrobotik starts* block with the *repeat until* block. After that, add a *Line Tracer Time* block by setting the speed to 80 within 3 seconds. Then, add another *Line Tracer Time* block by setting the speed to 30 within 3 seconds.

Step 3

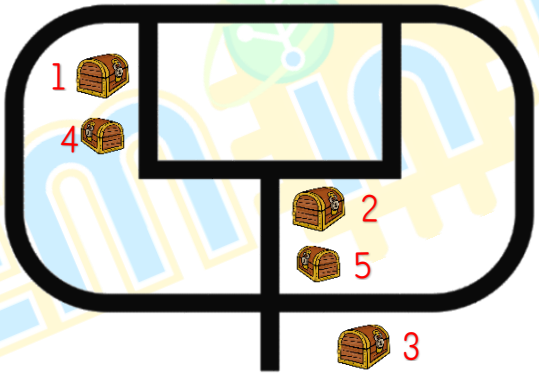
Add a *Turn at Centre* block and set it to make a left turn. Add another *Line Tracer Time* by setting the speed to 80 for 3 seconds. Then. add another *Line Tracer Time* block by setting the speed to 80 in 4 seconds.

Step 4

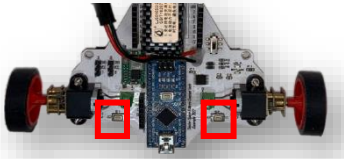
After uploading the code. turn on the Mikrobotik switch and perform the calibration process. After that. Mikrobotik will make all movements according to the set time and will stop after the set time.

Objective 10: Let's Find Hidden Treasures.

Sometimes the robot needs to use more than one block to complete a task such as "robot looking for hidden treasure". In order to get all five hidden treasures. the robot needs to go through many intersections. among which are left junctions. right junctions and 3-way junctions. Sometimes the robot needs to turn at different speeds to enter the junction.



Introduction to Push Button



A push button is a type of switch that functions to control a machine directly through the touch of a hand or finger from the user or the surface of a component. Mikrobotik has push buttons S1 and S2. The analog reading value will be less than 400 when S1 is pressed while the analog reading will be less than 500 when S2 is pressed.

Introduction to Movement and Its Mechanisms.

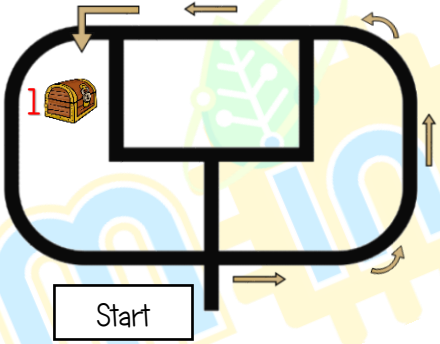
The technique used is to combine several *Path Finder* and *Path Finder Tank* blocks.

By using the *Path Finder* or *Path Finder Tank* block. the robot will move autonomously following the black or white line until it finds an intersection and then the robot will turn towards the specified intersection.

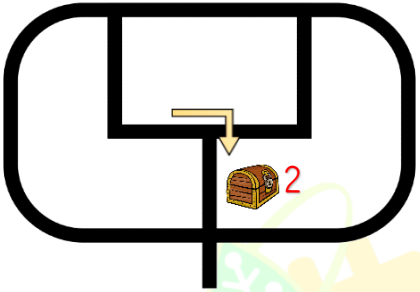
To get the first hidden treasure. the robot moves using the *Path Finder* until it finds a left intersection and turns to the left. Then. the robot continues moving using the *Path Finder* until it finds a right intersection and turns to the right for the second hidden treasure. Next. the robot continues moving using the *Path Finder* until it finds a 3-way junction and turns left for the third hidden treasure. After that. to get the fourth haunted treasure the robot needs to use the *Path Finder Tank* until it meets the left intersection and turn left and finally to get the last haunted treasure the robot needs to use the *Path Finder Tank* until it finds the right intersection and turns right.

Here is a sketch of the movement of the robot searching for hidden treasures by going through different intersections to complete the task.

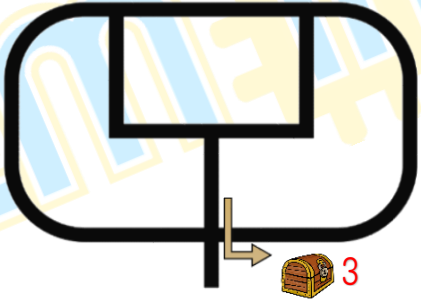
i) The robot moves from the starting point to find the left junction and turns using the *Path Finder* to the left to pick up the first hidden treasure.



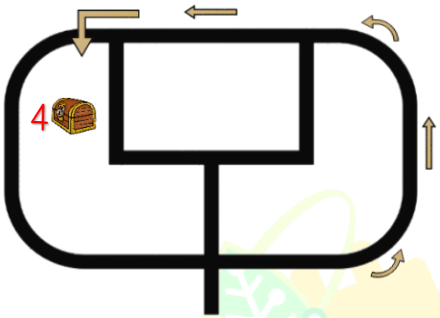
ii) The robot moves to find the right junction and turns using the *Path Finder* round to the right to pick up the second hidden treasure.



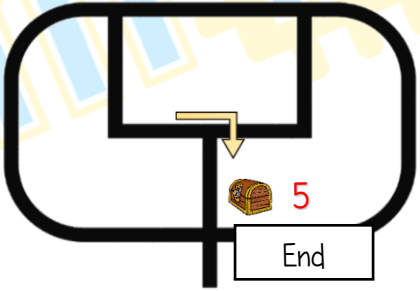
iii) The robot moves to find the 3-way intersection and turns using the *Path Finder* to the left to pick up the third hidden treasure.



iv) The robot moves again to find the left junction and turns using the *Path Finder Tank* to the left to pick up the fourth hidden treasure.

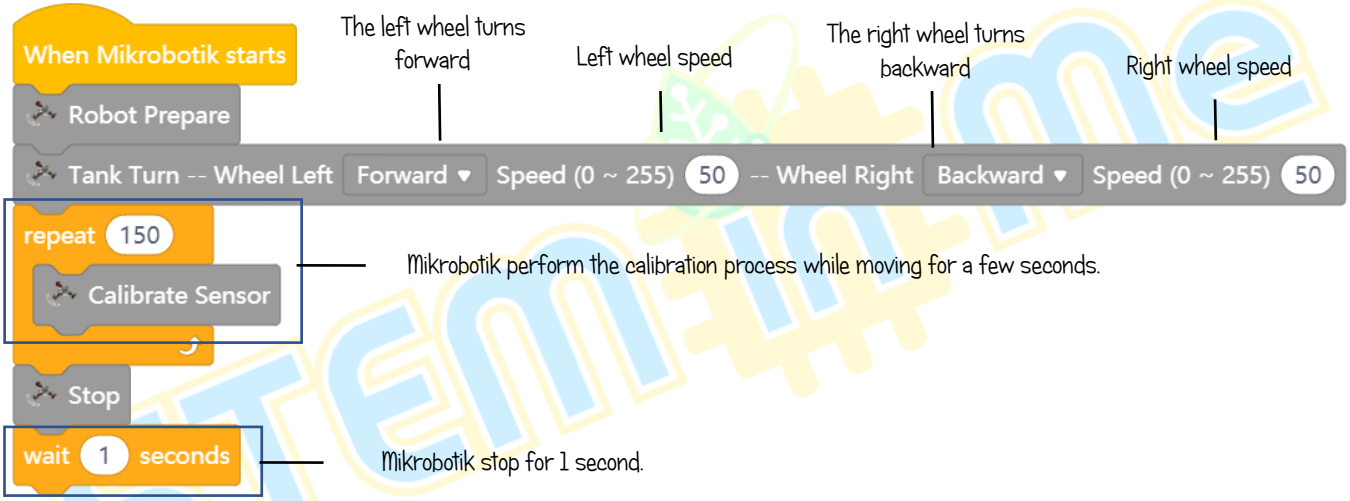


v) The robot continues to move looking for the right junction and turns using the *Path Finder Tank* to the right to take the last hidden treasure and then stops .



Step by Step Block Arrangement:

Step 1 Set up an automatic calibration block arrangement.



Step 2

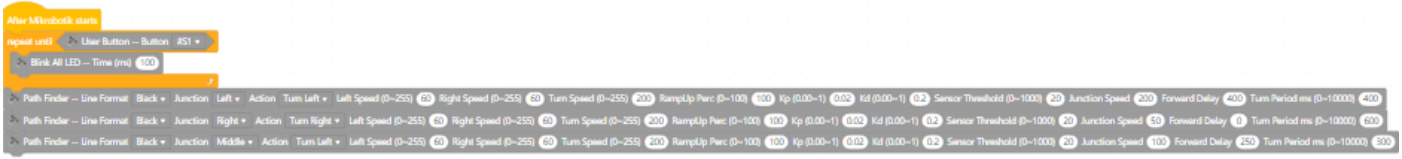
Combine the *After Mikrobotik starts* block with the *repeat until* block. After that, add the *Path Finder* block and set it (*Junction – "**Left**". Action – "**Turn Left**". Speed – "**60**". Turn Speed – "**200**". Junction Speed – "**200**". Forward Delay – "**400**" and Turn Period – "**400**"*).

Step 3

Add a new *Path Finder* block and set the value to (*Junction – "**Right**". Action – "**Turn Right**". Speed – "**60**". Turn Speed – "**200**". Junction Speed – "**50**". Forward Delay – "**0**"* and *Turn Period – "**600**"*).

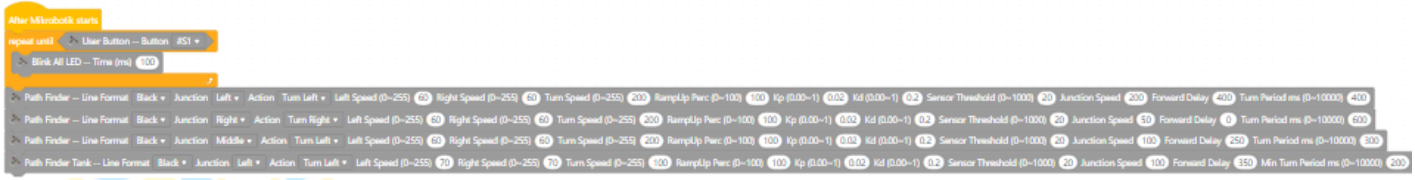
Step 4

Add a new *Path Finder* block and set the value to (*Junction* – *"**Middle**"*. *Action* – *"**Turn Left**"*. *Speed* – *"**60**"*. *Turn Speed* – *"**200**"*. *Junction Speed* – *"**100**"*. *Forward Delay* – *"**250**"* and *Turn Period* – *"**300**"*).



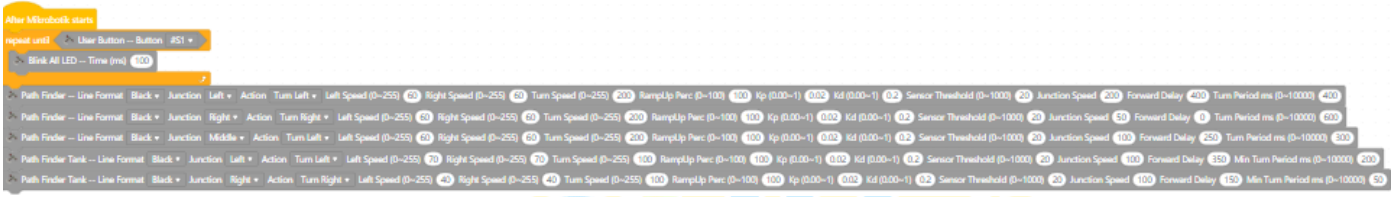
Step 5

Add a *Path Finder Tank* block and set the value to (*Junction* – *"**Left**"*. *Action* – *"**Turn Left**"*. *Speed* – *"**70**"*. *Turn Speed* – *"**100**"*. *Junction Speed* – *"**100**"*. *Forward Delay* – *"**350**"* and *Min Turn Period* – *"**200**"*).



Step 6

Add a new *Path Finder Tank* block and set the value to (*Junction – "**Right**". Action – **Turn Right**". Speed – "**40**". Turn Speed – "**100**". Junction Speed – "**100**". Forward Delay – "**150**"* and *Min Turn Period – "**50**"*).

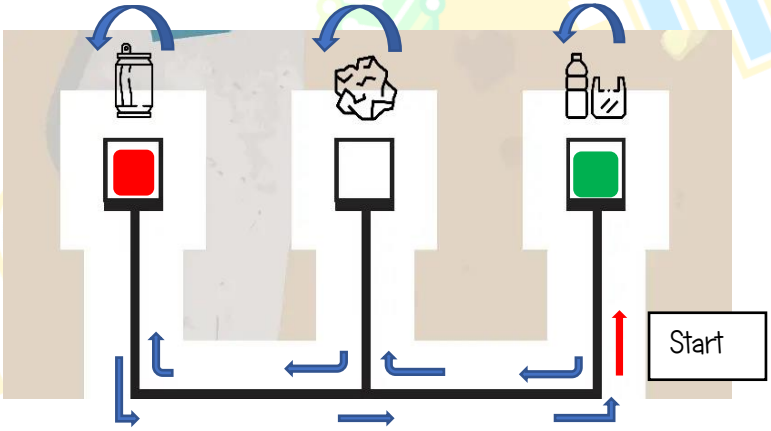


Step 7

After uploading the code. turn on the Mikrobotik switch and perform the calibration process. After that. Mikrobotik will move to find the designated intersection and make a circle until it finds the hidden treasure.

Objective 11: Recycling Material Separation.

This objective focuses on the effort of material separation for recycling using robots. To aid in recycling efforts, we can employ robots to move recyclable objects from one location to a specific designated area. For this purpose, the robot utilizes a gripper tool to grasp the recyclable object, then the robot moves from one location to the designated area, and finally releases the object.



Introduction to Single Gripper and Its Mechanism

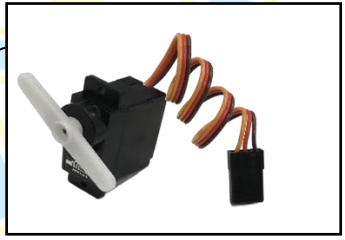
The single gripper is used in Mikrobotik to grasp objects and move (drag) them to the desired location. The single gripper consists of one servo motor and one mechanical gripper hand.

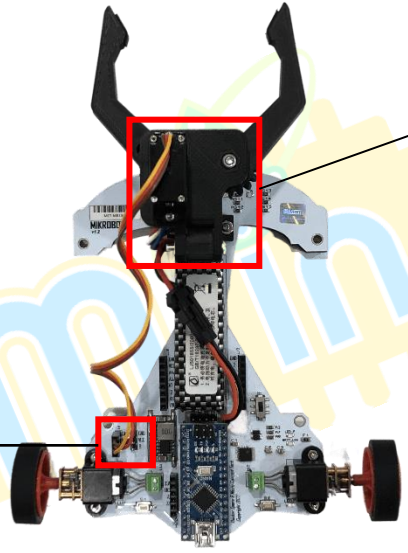
The single gripper is mounted on Mikrobotik using screws and nuts. while the servo motor wire is connected to the existing servo pot pins labelled "P1" or "P2" on Mikrobotik.

The width of the gripper hand's opening can be adjusted by setting the servo motor's angle. A larger servo angle results in a smaller gripper hand opening. Typically, when the servo motor angle is set to 0 degrees. the gripper hand is in its widest position. When the servo motor angle is set to 180 degrees. the gripper hand is in its smallest or fully closed position.

Installation of the Single Gripper on the robot

Servo Motor
(Gripper Width Angle)



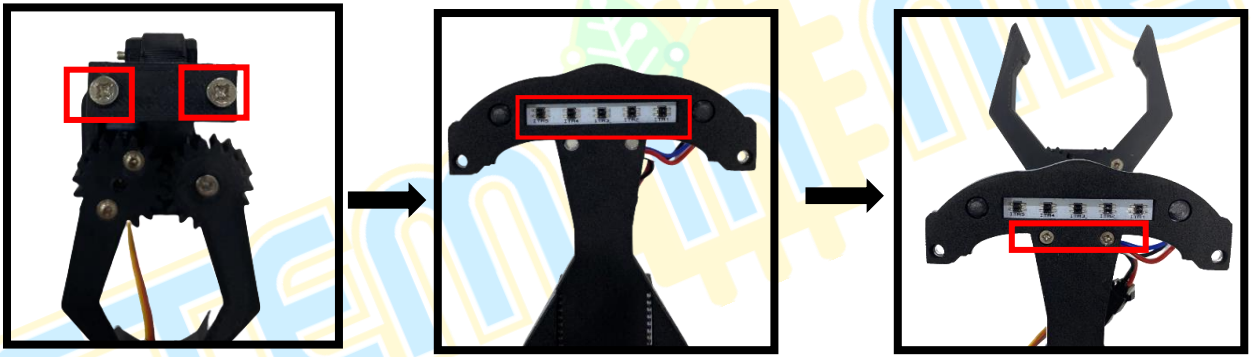


Pot Pin P1 or P2

Brown– GND
Red – VCC
Yellow –7

Here is the sequence of steps for installing a *Single Gripper* on Mikrobotik:

1- Loosen the screws and nuts on the *Single Grippers*. There are two screw holes for the *Single Grippers* under the Mikrobotik robot. Insert the screws and nuts. then tighten them.



2- Ensure the position of the *Single Gripper* after installation is like this.

Arrange Strategy and Movement Techniques.

The technique used is by combining several blocks: *Path Finder*, *Gripper Servo Port*, and *Turn at Centre*.

Using the *Path Finder* block, the robot will autonomously move following black or white lines until it encounters the first object (green).

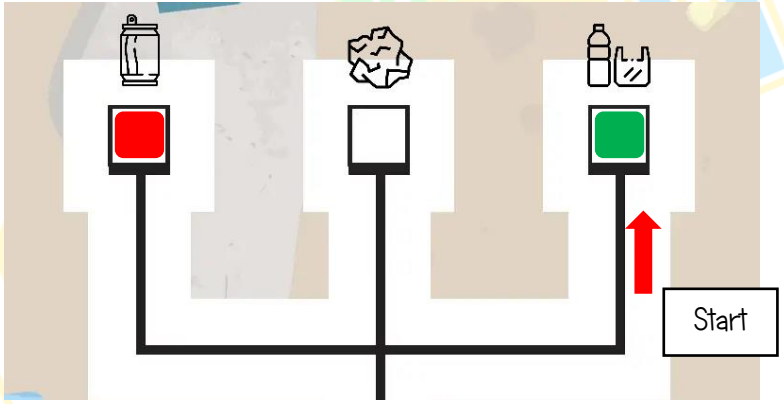
To obtain the first object (green), the robot will grasp it using the *Gripper Servo Port* block. Then, the robot will rotate using the *Turn at Centre* block and continue its movement using several *Path Finder* blocks until it reaches a left-right junction in a designated area. It will stop to place the object into the designated area using the *Gripper Servo Port*.

Next, the robot will rotate using the *Turn at Centre* block and continue its movement using several *Path Finder* blocks until it reaches a left-right junction in the designated area. It will stop to pick up the second object (red) using the *Gripper Servo Port*.

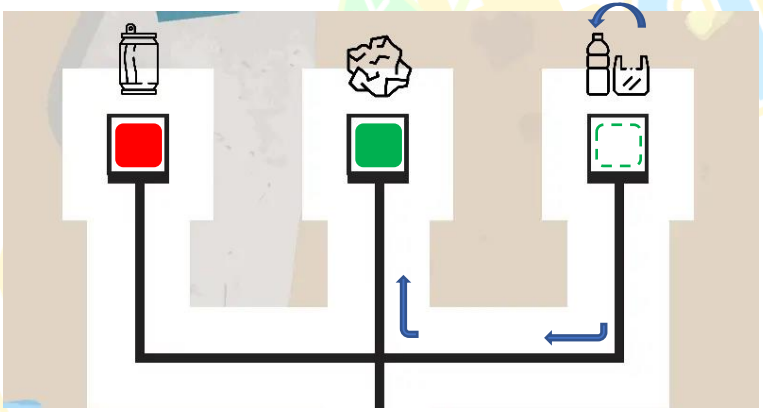
Afterward, the robot will rotate using the *Turn at Centre* block and move using several *Path Finder* blocks until it reaches a left-right junction in the designated area. It will then place the second object into the designated area using the *Gripper Servo Port*.

Here is a provided sketch of the robot's movements for individually picking up objects and arranging them in designated spaces.

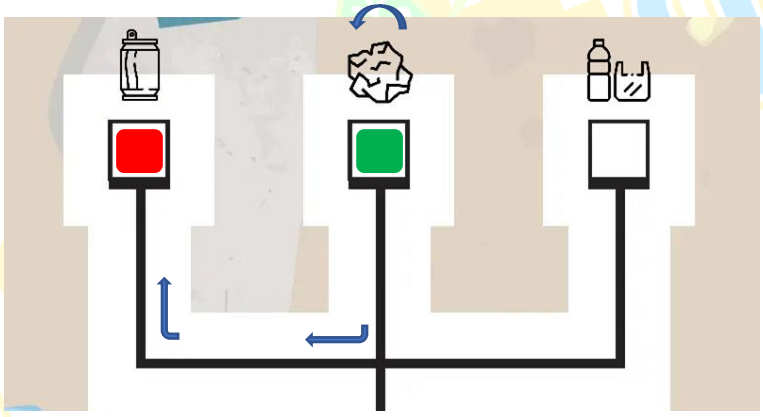
i) Using the Path Finder block. the robot moves from the starting point until it reaches a left-right junction and stops. Then. the robot grasps the first object (green) using the Gripper Servo Port block (Gripper) with a large angle setting (small gripper opening).



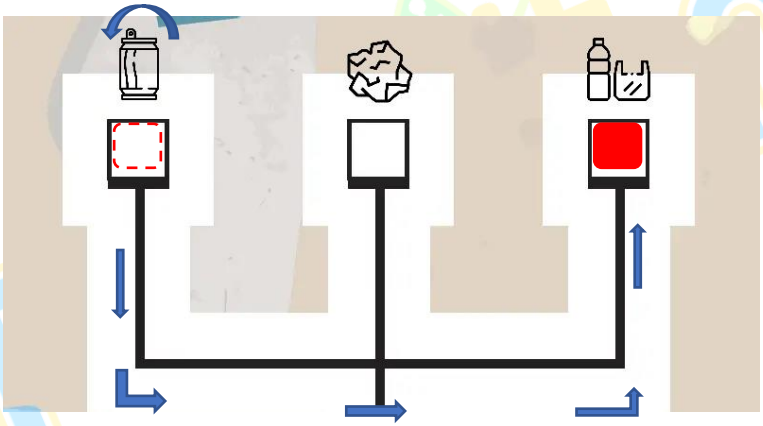
ii) The robot rotates to face the opposite direction using the *Turn at Centre* block. Then, the robot moves using the *Path Finder* block until it reaches a right junction and turns to the right. Subsequently, the robot moves using the *Path Finder* block until it reaches a left-right junction and turns to the right. After that, the robot moves using the *Path Finder* block until it reaches a left-right junction and stops. Finally, it releases the second object (red) into a designated space using the *Gripper Servo Port* block with a small angle setting (large gripper opening).



iii) After releasing the first object. the robot rotates to face the opposite direction using the *Turn at Centre* block. Then. the robot moves using the *Path Finder* block until it reaches a left-right junction and turns to the right. After that. the robot moves using the *Path Finder* block until it reaches a right junction and turns to the right. then stops. Next, the robot grasps the second object (red) using the *Gripper Servo Port* block (Gripper) with a large angle setting (small gripper opening).



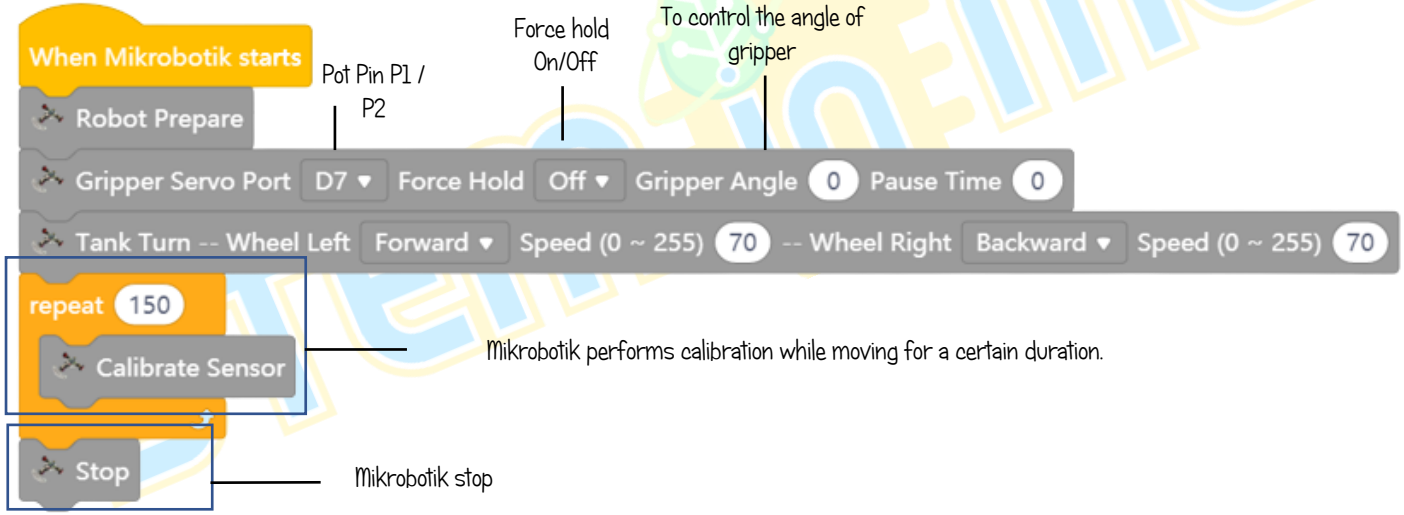
iv) The robot rotates to face the opposite direction using the *Turn at Centre* block. Then, the robot moves using the *Path Finder* block until it reaches a left junction and turns to the left. Subsequently, the robot moves using the *Path Finder* block until it reaches another left junction and turns left again. After that, the robot moves using the *Path Finder* block until it reaches a left-right junction and stops. Finally, it releases the second object (red) into a designated space using the *Gripper Servo Port* block with a small angle setting (large gripper opening).



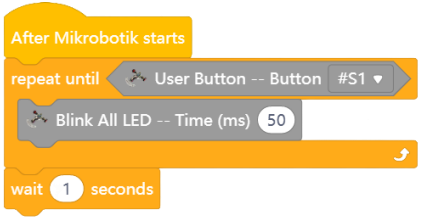
Step by Step block arrangement:

Step 1	Connect the wire of the *single gripper* servo motor to the pot labelled P1 or P2..

Step 2	Prepare the blocks arrangement for automatic calibration.



Step 3 Combine the *After Mikrobotik starts* block with the *repeat until* block and add a *wait 1 second* block.



Step 4 Add a *Path Finder* block and configure it with the following settings (*Juction* – *"Middle"*. *Action* – *"Stop"*. *Speed* – *"50"*. *Turn Speed* – *"50"*. *Junction Speed* – *"50"*. *Forward Delay* – *"0"* dan *Turn Period* – *"0"*). Then, add a *Gripper* block and configure it with these settings (*Gripper Servo Port* – *"D7"*. *Force hold* – *"On"*. *Gripper Angle* – *"133"*. *Pause* – *"0"*). Finally, include a *Turn At Centre* block with these settings (*Direction Turn* – *"Left"*. *Speed* – *"50"*. *MinTurn Period* – *"600"*).

Step 5

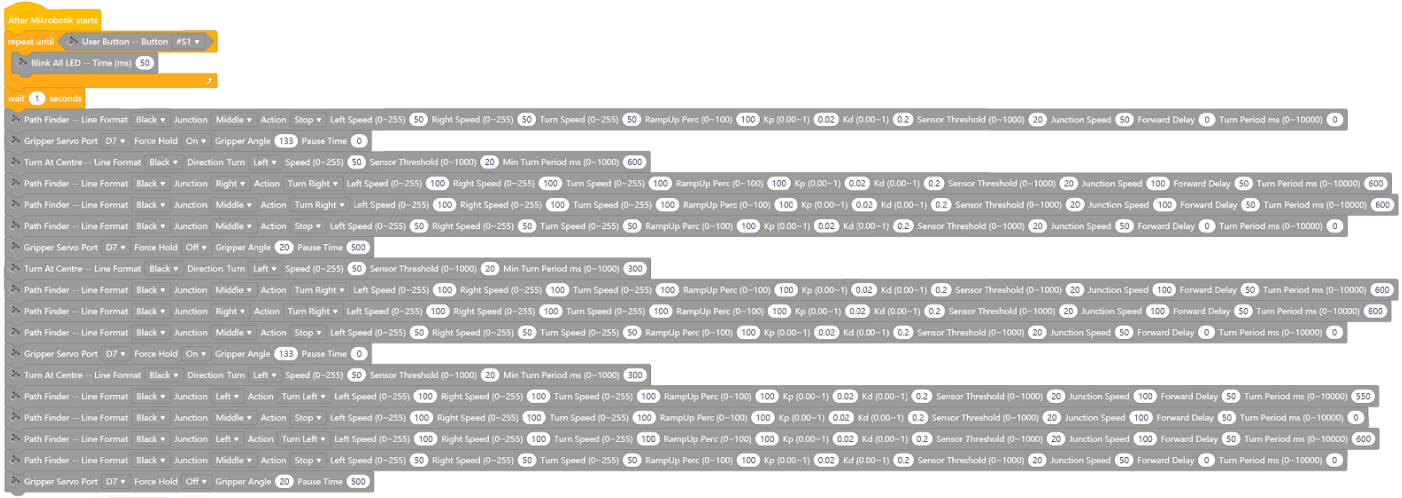
Add a *Path Finder* block and configure it with the following settings (*Junction – ["Right", "Middle", "Middle"]. Action – ["Turn Right", Turn Right", "Stop"]. Speed – ["100", "100", "50"]. Turn Speed – ["100", "100", "50"]. Junction Speed – "["100", "100", "50"]. Forward Delay – ["50", "50", "0"]* dan *Turn Period – ["600", "600", "0"]*). Then, add a *Gripper* block and configure it with these settings (*Gripper Servo Port – "D7", Force hold – "Off", Gripper Angle – "20", Pause – "500").* Finally, include a *Turn At Centre* block with these settings *(Direction Turn – "Left", Speed – "50", MinTurn Period – "300").*

Step 6

Add 3 *Path Finder* blocks and configure them in the following sequence (*Juction – ["**Middle**". "**Right**". "**Middle**"]. Action – ["**Turn Right**". **Turn Right**". "**Stop**"]. Speed – ["**100**". "**100**". "**50**"]. Turn Speed – ["**100**". "**100**". "**50**"]. Junction Speed – "["**100**". "**100**". "**50**"]. Forward Delay – ["**50**". "**50**". "**0**"]* dan *Turn Period – ["**600**". "**600**". "**0**"]*). Add a *Gripper* block and configure it with the following settings (*Gripper Servo Port – "**D7**". Force hold – "**On**". Gripper Angle – "**133**". Pause – "**0**").* Then, add a *Turn At Centre* block with the following settings *(Direction Turn – "**Left**". Speed – "**50**". Min Turn Period – "**300**").*

Step 7

Add 4 *Path Finder* blocks in the following sequence (*Juction – ["**Left**". "**Middle**". "**Left**". "**Middle**"]. Action – ["**Turn Left**". "**Stop**". "**Turn Left**". "**Stop**"]. Speed – ["**100**". "**100**". "**50**"]. Turn Speed – ["**100**". "**100**". "**50**"]. Junction Speed – "["**100**". "**100**". "**100**". "**50**"]. Forward Delay – ["**50**". "**50**". **50**". "**0**"]* dan *Turn Period – ["**550**". "**0**". "**600**". "**0**"]*). Next, add a *Gripper* block and configure it with the following settings (*Gripper Servo Port – "**D7**". Force hold – "**Off**". Gripper Angle – "**20**". Pause – "**550**").*



Extra Information

Force Hold (Daya Cengkaman)

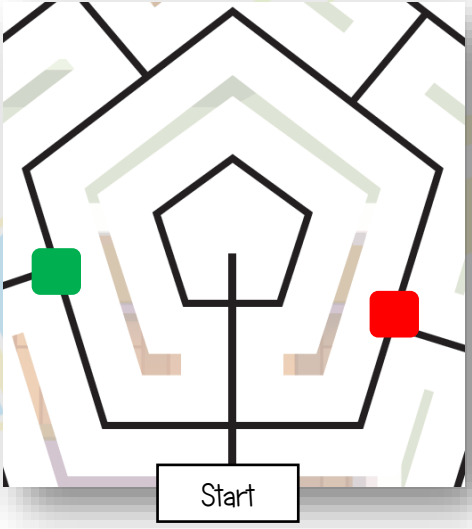
- When the force hold is turned on (ON). the gripper will maintain its gripper width angle and prevent it from being changed.
- When the force hold is turned off (OFF). the gripper will no longer maintain its gripper width angle. and it can be adjusted freely.

Pause Time (Tempoh Jeda)

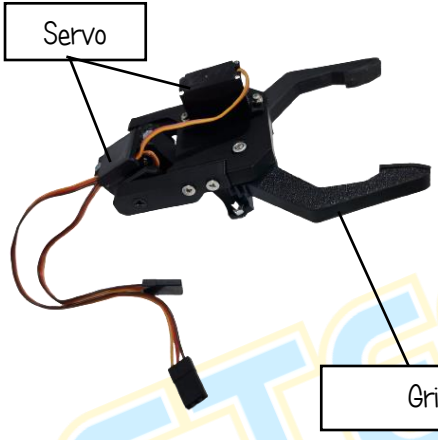
- The pause time function can only be used when the force hold is turned off (OFF).
- The pause time function is used to activate the force hold for a specified duration. Once the pause time expires. the force hold will be turned off.

Objective 12: Efficient Space Storage

Sometimes, we need to arrange a large number of objects in a sequential manner to fully utilize space. This is where a dual servo gripper comes into play. Just as its name suggests, it is equipped with two servo motors.

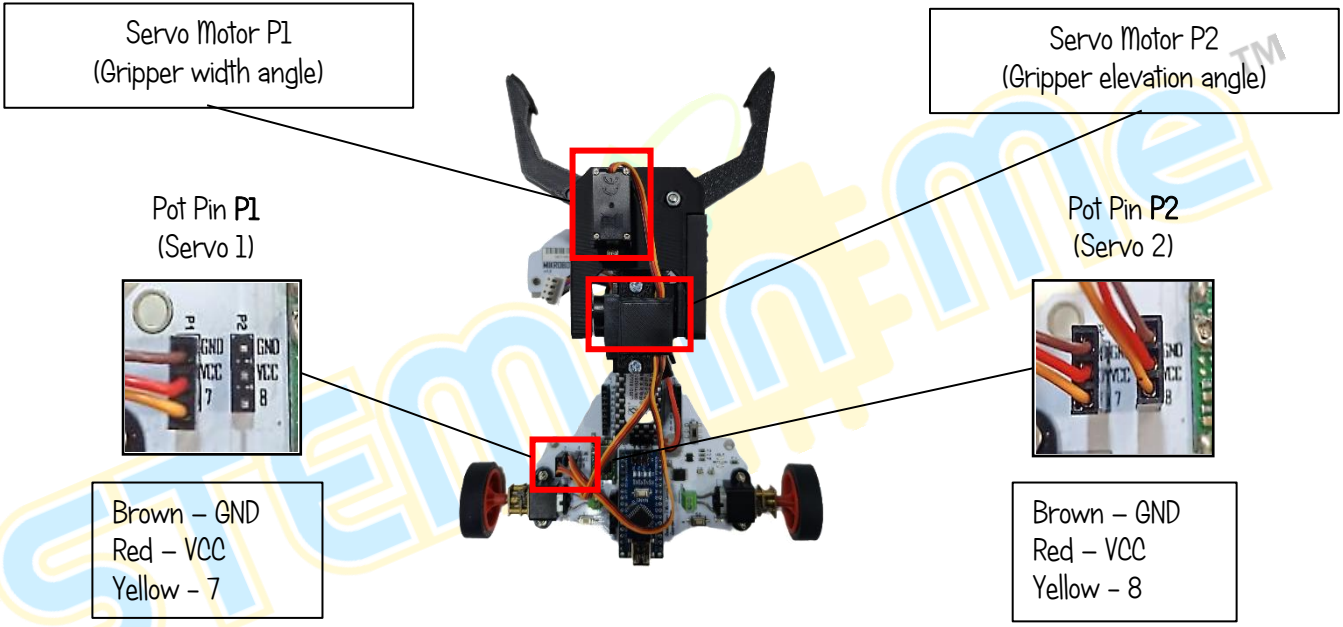


Introduction to Dual Gripper and Its Mechanism



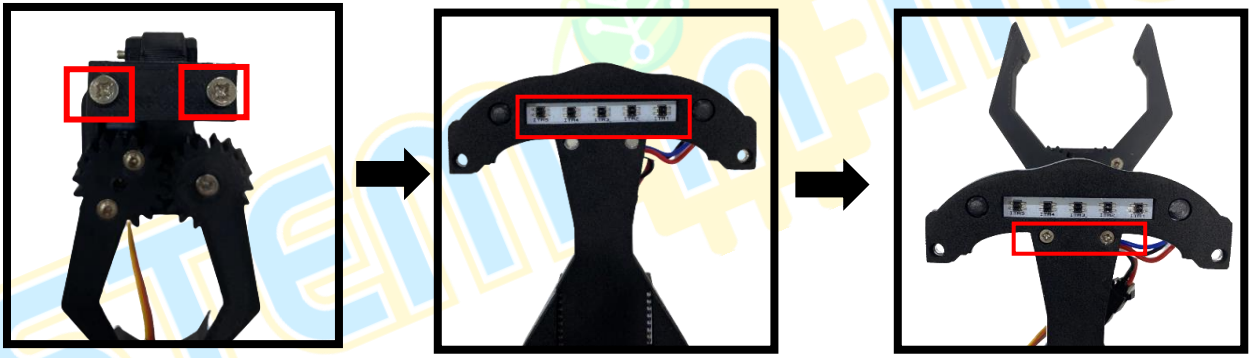
The first servo motor is used to control the gripper's width. while the second servo motor is used to control the gripper's lifting angle. Therefore. when installed on Micro-robotics. the robot will be able to grasp and lift objects. The servo wires are connected to the existing servo header pins labeled "P1" and "P2."

Installation of Dual Grippers on the robot



Here is the sequence of steps for installing a Dual Gripper on Mikrobotik:

1- Loosen the screws and nuts on the *Dual Gripper*. Below the Mikrobotik robot. there are two screw holes for the *Dual Gripper*. Insert the screws and nuts. then tighten them.



2- Ensure the position of the *Dual Gripper* after installation is like this.

Arrange Strategy and Movement Techniques.

The technique used involves combining several blocks, including Path Finder, Line Tracer Time, Gripper Servo Port, and Turn at Centre.

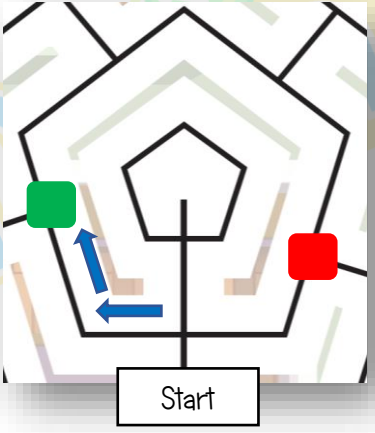
By using the Path Finder and Line Tracer Time blocks, the robot will autonomously move along black or white lines until it encounters the first object.

To obtain the first object (green), the robot will grasp it using the Gripper Servo Port block. Then, the robot will rotate using the Turn at Centre block and continue its movement using the Path Finder block until it reaches a left junction, where the robot will turn left. Subsequently, the robot will keep moving using the Path Finder block until it encounters a left-right junction, at which point the robot will turn left. Next, the robot will continue its movement using the Path Finder block until it reaches a dead-end and stops to place the object into a designated space using the Gripper Servo Port block.Following this, the robot will rotate using the *Turn at Centre* block and continue its movement using several *Path Finder* blocks until it encounters a left-right junction. The robot will then turn left and move using *Line Tracer Time* to pick up the second object (red) using the *Gripper Servo Port* block. After that, the robot will rotate using the *Turn at Centre* block and move using several *Path Finder* blocks until it reaches a right junction and then a right-left junction. The robot will turn right.

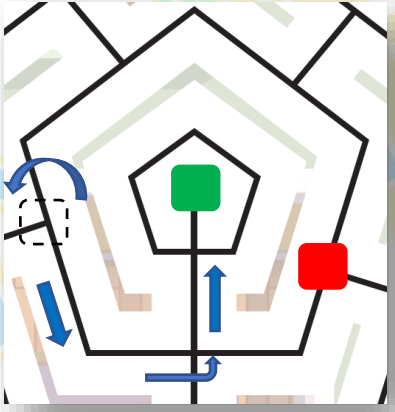
Subsequently, the robot will pick up the object using the *Gripper Servo Port* block and move using the *Path Finder* block until it reaches a dead-end, where it will stop to place the second object (red) sequentially into a designated space using *the Gripper Servo Port* block. Finally, the robot will rotate using the *Turn at Centre* block and move using the *Path Finder* block until it encounters a left-right junction and stops.

Here is a provided sketch of the robot's movements for individually picking up objects and arranging them sequentially in the same space

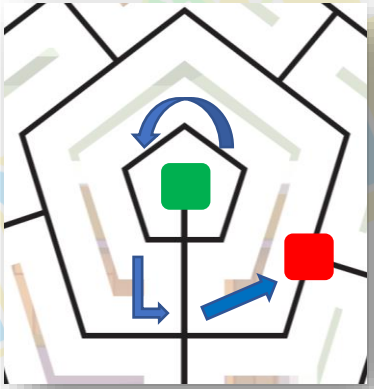
.i) Using the *Path Finder* block. the robot moves from the starting point until it reaches a left-right junction and turns left. Then. the robot moves using the *Path Finder* block and encounters a right junction. where it turns right. Afterward. it uses the *Line Tracer Time* block and grasps the first object (green) using the *Gripper Servo Port* block (Gripper) with a large angle setting (small gripper opening).



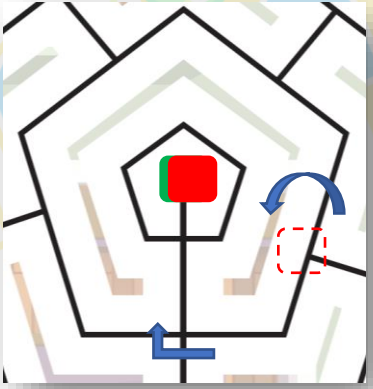
ii) The robot rotates to face the opposite direction using the *Turn at Centre* block. Then, the robot moves using the *Path Finder* block until it reaches a left junction and turns left. Next, the robot moves using the *Path Finder* block until it encounters a left-right junction, where it turns left. After that, the robot moves using the *Path Finder* block until it reaches a dead-end and stops. It then releases the first object (green) into a designated space using *the Gripper Servo Port* block with a small angle setting (large gripper opening).



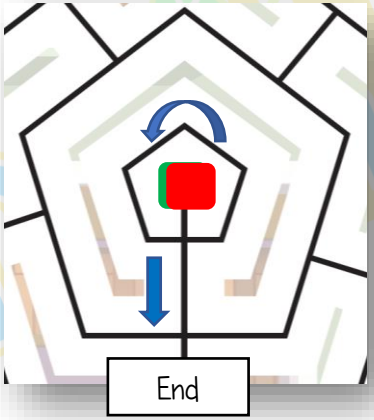
iii) After releasing the first object (green). the robot rotates to face the opposite direction using the *Turn at Centre* block. Then. the robot moves using the *Path Finder* block until it reaches a left-right junction and turns left. Subsequently. the robot continues to move using the *Path Finder* block until it encounters a left junction. where it turns left. Next. it uses the *Line Tracer Time* block and grasps the second object (red) using the *Gripper Servo Port* block (*Gripper*) with a large angle setting (small gripper opening)..



iv) The robot rotates to face the opposite direction using the *Turn at Centre* block. Then, the robot moves using *the Path Finder* block until it reaches a right junction and turns right. Next, the robot continues to move using the *Path Finder* block until it encounters a left-right junction, where it turns right and stops. It then lifts the second object (red) using the *Gripper Servo Port* block with a large angle setting (hand height). Afterward, the robot moves using the *Path Finder* block and proceeds to a dead-end junction where it stops. Following this, the robot sequentially places and releases the second object (red) into a designated space using the *Gripper Servo Port* block with both a large angle setting (hand height) and a small angle setting (large gripper opening).



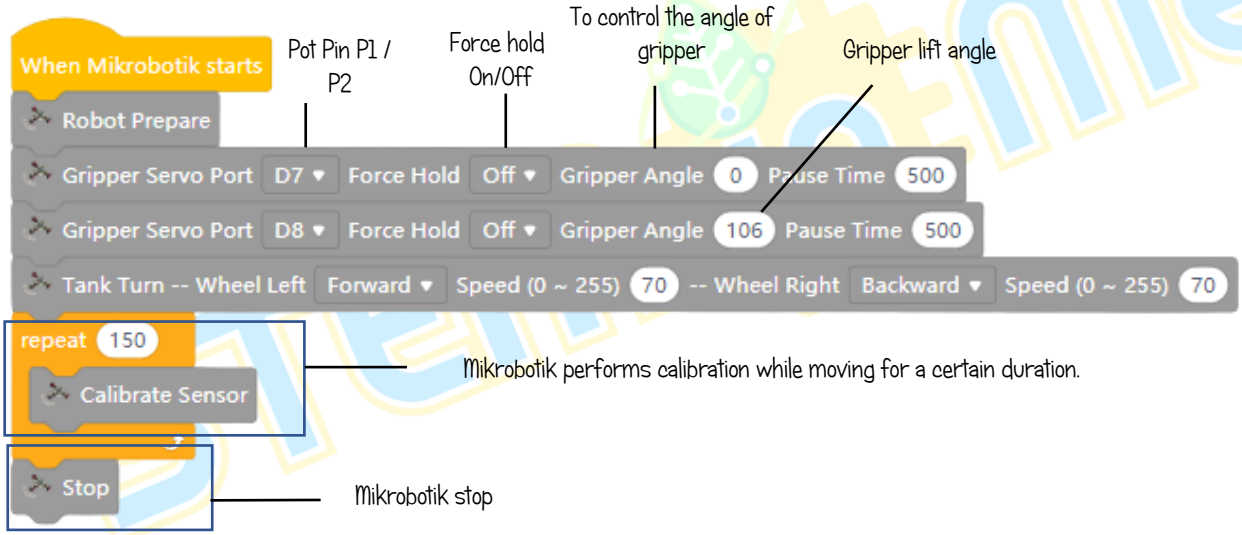
v) The robot rotates to face the opposite direction using the *Turn at Centre* block and moves using the *Path Finder* block until it reaches a left-right junction and then stops.



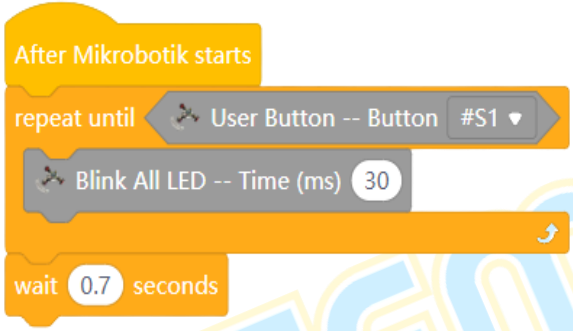
Step by Step block arrangement:

Step 1	Connect the wire of the *servo motor* to the pot labelled P1 and P2..

Step 2	Prepare the blocks arrangement for automatic calibration.



Step 3	Combine the *After Mikrobotik starts* block with a *repeat until* block. and insert a *wait* 0.7 seconds block within the *repeat until* block.



Step 4

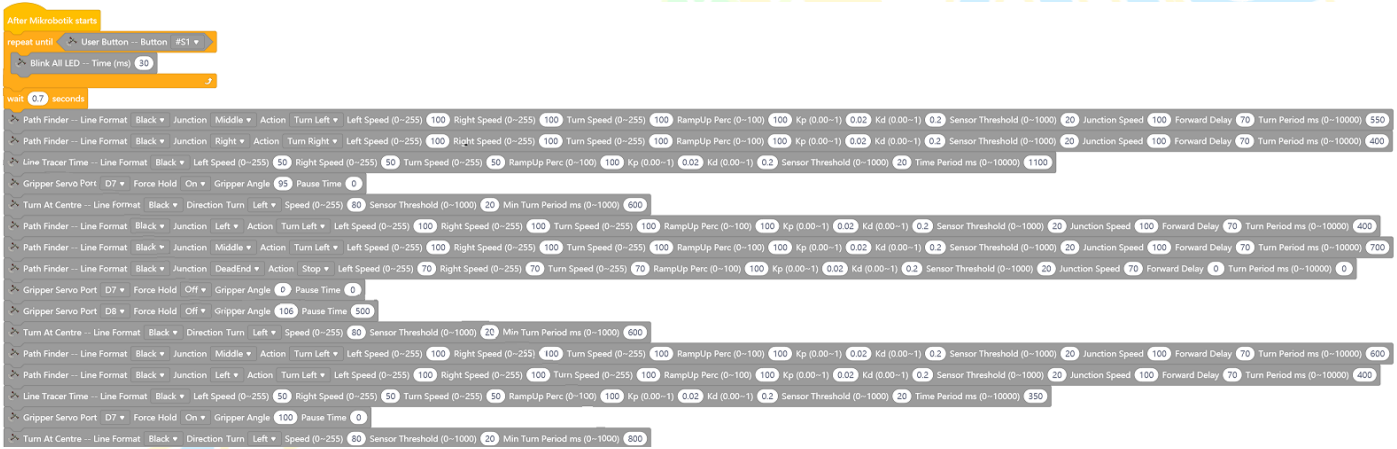
Add 2 *Path Finder* blocks and set the values as follows (*Juction – ["**Middle**". "**Right**"]. Action – ["**Turn Left**". "**Turn Right**"]. Speed – ["**100**". "**100**"]. Turn Speed – ["**100**". "**100**"]. Junction Speed – ["**100**". "**100**"]. Forward Delay – ["**70**" . "**70**"]* dan *Turn Period – ["**550**". "**400**"]*). Next, add a *Line Tracer Time* block and configure it with the following values (Speed – "**50**". Turn Speed – "**50**". Time Period – "**1100**"). Then, include a *Gripper* block with these settings (*Gripper Servo Port – "**D7**". Force hold – "**On**". Gripper Angle – "**95**". Pause – "**0**").* Finally, add a *Turn At Centre* block with the following parameters *(Direction Turn – "**Left**". Speed – "**80**". MinTurn Period – "**600**").*

Step 5

Add 3 *Path Finder* blocks and set the values in the following order (*Juction – ["**Left**". "**Middle**". "**DeadEnd**"]. Action – ["**Turn Left**". **Turn Left**". "**Stop**"]. Speed – ["**100**". "**100**". "**70**"]. Turn Speed – ["**100**". "**100**". "**70**"]. Junction Speed – "["**100**". "**100**". "**70**"]. Forward Delay – ["**70**". "**70**". "**0**"]* dan *Turn Period – ["**400**". "**700**". "**0**"]*). Then, add 2 *Gripper* blocks and configure them with the following values (*Gripper Servo Port – ["**D7**". "**D8**"]. Force hold – ["**Off**". "**Off**"]. Gripper Angle – ["**0**". "**106**"]. Pause – ["**0**". "**500**"]).* Finally, include a *Turn At Centre* block with these settings *(Direction Turn – "**Left**". Speed – "**80**". Min Turn Period – "**600**").*

Step 6

Add 2 Path Finder blocks and set the values in the following sequence (*Juction – ["Middle". "Left"]. Action – ["Turn Left". Turn Left"]. Speed – ["100". "100"]. Turn Speed – ["100". "100"]. Junction Speed – "["100". "100"]. Forward Delay – ["70". "70"]* dan *Turn Period – ["600". "400"]*). Add *a Line Tracer Time* block and set the values as follows (*Speed – "50". Turn Speed – "50". Time Period – "350").* Add a *Gripper* block and configure it with the following values (*Gripper Servo Port – "D7". Force hold – "On". Gripper Angle – "100". Pause - "0").* followed by a *Turn At Centre* block. *(Direction Turn – "Left". Speed – "80". MinTurn Period – "800").*



Step 7

Add 2 *Path Finder* blocks and set the values in the following sequence (*Juction* – *["**Right**". "**Middle**".]. Action* – *["**Turn Right**". **Turn Right**"]. Speed* – *["**100**". "**100**"]. Turn Speed* – *["**100**". "**100**"]. Junction Speed* – *"["**100**". "**100**"]. Forward Delay* – *["**100**". "**100**"]* dan *Turn Period* – *["**400**". "**700**"]*). Next, add a *Gripper* block and configure it with the following settings (*Gripper Servo Port* – *"**D8**". Force hold* – *"**On**". Gripper Angle* – *"**70**". Pause* - *"**500**").

Step 8

Add a *Path Finder* block and set the values as follows (*Juction* – *"DeadEnd"*. *Action* – *"Stop"*. *Speed* – *"70"*. *Turn Speed* – *"70"*. *Junction Speed* – *"70"*]. *Forward Delay* – *"0"* dan *Turn Period* – *"0"*). Then. add 2 Gripper blocks and configure them with the following settings (*Gripper Servo Port* – *["D8"* . *"D7"]*. *Force hold* – *["Off"*. *"Off"]*. *Gripper Angle* – *["90"*. *"0"]*. *Pause* – *["500"*. *"0"]*).

Step 9

Add a *Turn At Centre* block with the following settings *(Direction Turn – "**Left**". Speed – "**80**". Min Turn Period – "**600**").* Then, add a *Path Finder* block and configure it with the following values (*Junction – "**Middle**". Action – "**Stop**". Speed – "**100**". Turn Speed – "**100**". Junction Speed – "**100**". Forward Delay – "**70**"* and *Min Turn Period – "**100**"*).

Extra: Try Upgrade and Self Program

DEVICE PORT	ARDUINO NANO PIN	PERIPHERALS	ADDITIONAL INFO
ITR1	A6	Line Detection Sensor – Outer Left	ITR8307
ITR2	A3	Line Detection Sensor – Inside Left	ITR8307
ITR3	A2	Line Detection Sensor – Middle	ITR8307
ITR4	A1	Line Detection Sensor – Inside Right	ITR8307
ITR5	A0	Line Detection Sensor – Outer Right	ITR8307
S1	A7	User Switch S1	Value < 100
S2	A7	User Switch S2	Value ≥ 100 & < 400
BUZZER	D2	Buzzer	
LED1	D13	Indicator Light L1	
LED2	D12	Indicator Light L2	
M1 – AIN1	D5	Left Motor – Bridge A Input 1	DRV8833 Dual H-Bridge Motor Driver
M1 – AIN2	D6	Left Motor – Bridge A Input 2	DRV8833 Dual H-Bridge Motor Driver
M2 – BIN1	D3	Right motor – Bridge B Input 1	DRV8833 Dual H-Bridge Motor Driver
M2 – BIN2	D9	Right motor – Bridge B Input 2	DRV8833 Dual H-Bridge Motor Driver
P1	D7	Open Pot P1	
P2	D8	Open Pot P2	
BT – TX	D10	Bluetooth Pot TX	
BT – RX	D11	Bluetooth Pot RX	

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MERAKYATKAN TEKNOLOGI

- Industry 4WRD
- Pemikiran Kreatif
- Pembudayaan Inovasi
- Kesejahteraan Hidup
- Kelestarian Alam
- Pembelajaran Menyeronokkan

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