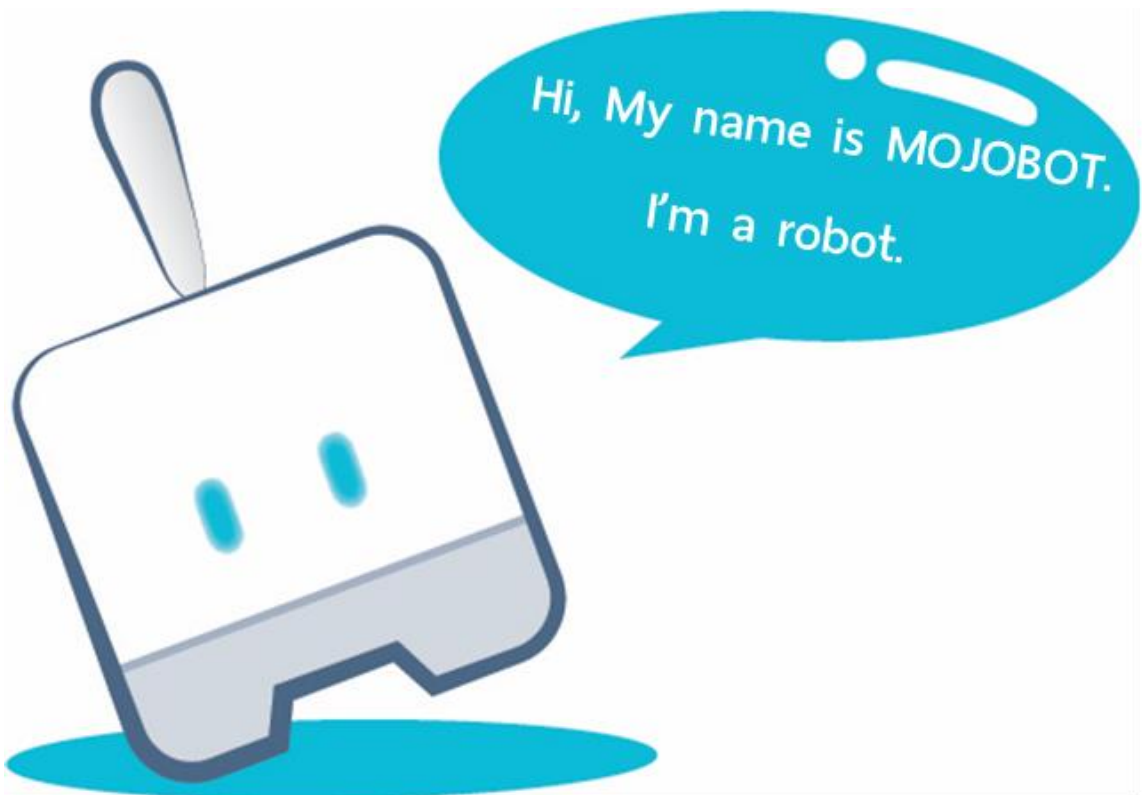


Mojobot Level 2



Contents

Preface	3
Activity 1 - Add On Console: Extend your Code	4
Activity 2 - Repeat and Multiply	6
Activity 3 - Repeat as a pattern	9
Activity 4 - How to repeat to be in a position	6
Activity 5 - Mojo Shy bot	13
Activity 6 - Dance Bot	16
Activity 7 - Delivery robot	19
Activity 8 - Mojobot Smart Lamp	22
Activity 9 - Mojobot Token Explorers	25
Activity 10 - Bull Robot	27
Activity 11 - Mojobot Dodging Explorer	29
Activity 12 - Mojobot Sweeper Cleaner	31
Activity 13 – Repeat Until Part 1	33
Activity 14 – Repeat Until Part 2	35
Activity 15 - Mojo and Sub-Routine	36
Activity 16 - Mojobot and Super Receptionist Robot	38
Activity 17 – Rescue Robot	39
Activity 18 - Super Mission Challenge	41

Preface

In Mojobot Level 2, the main focus is to build the understanding of how to create or code a program that enables Mojobot to make autonomous decisions automatically by itself using inputs from sensors. These lessons suitable for anyone from 6 years old and above.

Students will learn how to use flow control coding commands such as “loops” and “if statements” in conjunction with “conditional inputs” in order to control and obtain the desired autonomous robotic behavior. The activities utilize sensor inputs as simple boolean logic data where all values are either true or false. Mastery of flow control in computer programs are at the heart of computer science the design of algorithms. In other words, the aim is to get the learner more familiar with more advanced and fundamental concepts of computation thinking when compared to Mojobot Level 1.

After completing the Mojobot Level 2 lessons, the learners will understand the core concept of computational thinking and will be able to design algorithms to solve specific problems. Not only will learners be able to create algorithms that can work automatically, they will also develop problem solving skills, analytical skills, experimental skills, and creative thinking skills. Moreover, the lessons combine science and math's with creativity in language, art and design as students are encouraged to modify their robots and maps to tell their story, giving the curriculum content emphasis on STEAM as addition to STEM.

In conclusion, when compared with the Mojobot Level 1 lesson. The Mojobot Level 2 lesson aims to increase learners’ algorithmic thinking, systematic thinking and abstract thinking. These skills will prepare the learners to be ready for a more complicated coding languages such as Scratch or Python.

Activity 1 – Add On Console: Extend your Code

Purpose of the activity

This activity introduces the add on console to the students as a way of writing longer programs with Mojobot. The purpose of this activity is to get the students to work on longer more complicated programs which will help improve systematic thinking skills.

Material



Teaching Steps

1. The teacher reads out the instruction story from each example.
2. Students attempts to code the whole story into real life using 1 single program.

Example 1

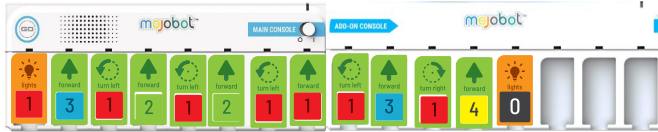
Mojobot is sad, so Mojobot goes out from the house, then heads north for 2 blocks, turns right once and then moves forward 3 blocks. Then Mojobot waits for 2 seconds and turns the tail lights to green. Now, Mojobot is happy and then heads back home using the same route.



Example 2

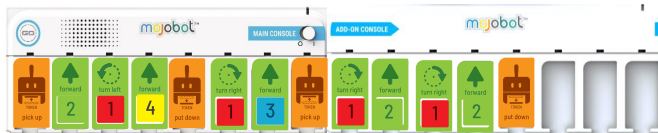
Mojobot has to deliver pizzas at 4 places. While it is on the way, his tail turns red whenever Mojobot finishes delivering a pizza, when it's finished, the tail light will be off.

Delivery Route: Office Buildings - Home - Mechanic Shop - Sport Complex



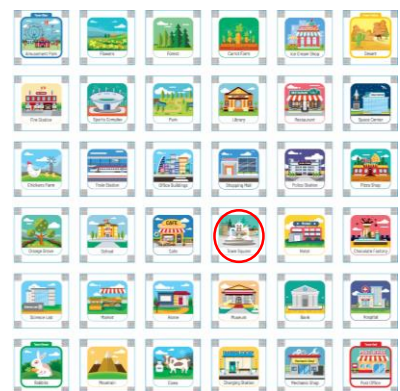
Example 3

Mojobot picks up the Fossil Token at the Desert and puts it down at the Museum. Then it picks up Scientific Sample Token at the Science Lab and delivers it to the Shopping Mall for a special science exhibition.



Example 4

Mojobot is at Town Square and suddenly starts to dance. After dancing Mojobot displays the tail light in green, red, yellow, and then blue, for 2 seconds each. Then it turns off the light and dances again. Finally Mojobot make a happy face.



Activity 2 – Repeat and Multiply

Purpose of the activity

This activity aims to introduce to learners the concept of repeating and looping in coding. Students learn that repetition through looping is the same as math multiplication.

Material



Example 1



Put Mojobot @ hospital and facing to the west.

Mojobot goes forward 1 block repeat 5 times.

The result is $1+1+1+1+1 = 5$,

Meaning 1 plus 1 for 5 times or $5 \times 1 = 5$ blocks.

Example 2 Put Mojobot @ hospital and turn to the west.



Mojobot goes forward 5 blocks repeat 2 times.
 The result is $5+5 = 10$ blocks,
 Meaning 5 plus 5 for 2 times, calculate as $2 \times 5 = 10$ blocks.






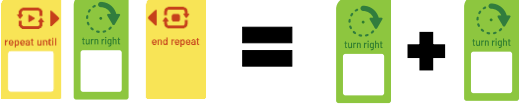
Example 3 Put Mojobot @ Restaurant and facing to the north.



Mojobot goes to the left 1 blocks repeat 5 times.
 $1+1+1+1+1 = 5$ blocks
 Meaning 1 plus 1 for 5 times calculate as $1 \times 5 = 5$ turns.

MISSION using Repeat correctly.

Explanation The learners fill in the blank the amount of Coding Tag number to correct the answer.

1.	 <p>Mojobot goes forward _____ blocks counted as _____ X _____</p>
2.	 <p>Mojobot goes forward _____ blocks counted as _____ X _____</p>
3.	 <p>Mojobot goes forward <u>3</u> blocks counted as _____ X _____</p>
4.	 <p>Mojobot goes forward <u>12</u> blocks counted as _____ X _____</p>
5.	 <p>Mojobot goes forward _____ blocks counted as _____ X _____</p>
6.	 <p>Mojobot goes left <u>4</u> blocks counted as _____ X _____</p>

** The instructor can use this activity as a guideline to add different difficulties to the mission as appropriate. **

Activity 3 – Repeat and Form a Pattern

Purpose of the activity

This activity aims to demonstrate to the students that repetition and looping could be used to form cyclic patterns. Such as moving back and forth or moving round and round in a square.

Material

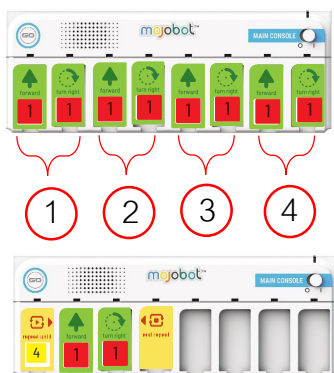


Teaching Steps

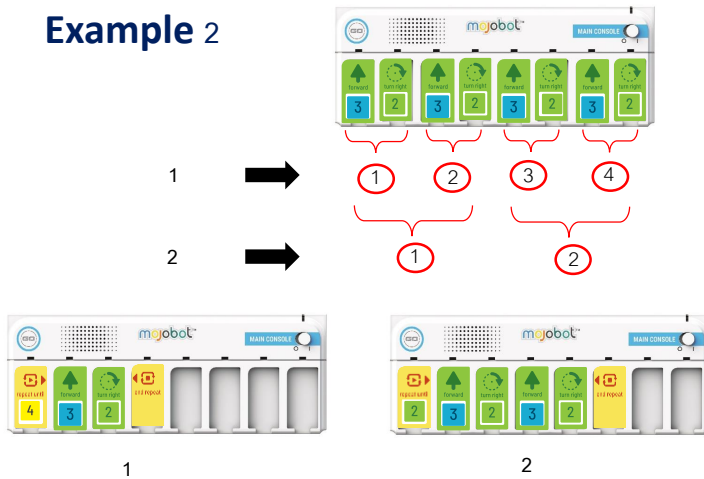
1. The instructor give the example of how to use “Repeat” to the learners. First show how to achieve the movement pattern without using “Repeat” then show it using “Repeat”. Let students observe and discuss the benefit of the “Repeat” command and the “looping” method.
2. Let students work through the other examples.

Note: Don't forget to put Mojobot, facing the north at the beginning of each round.

Example 1

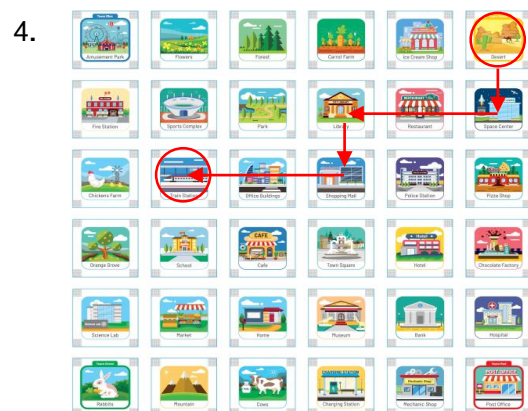
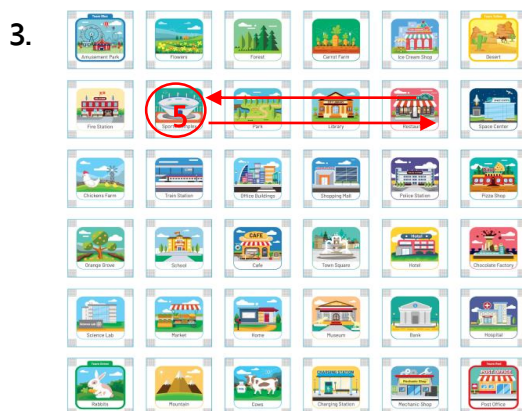
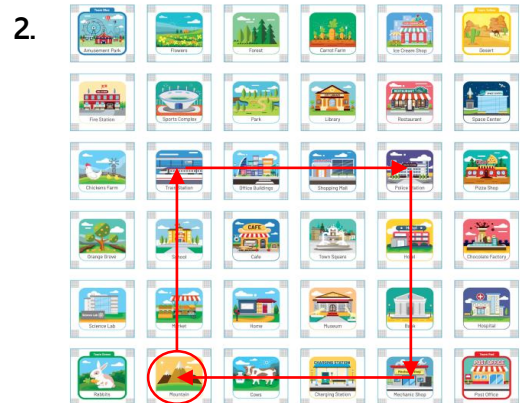
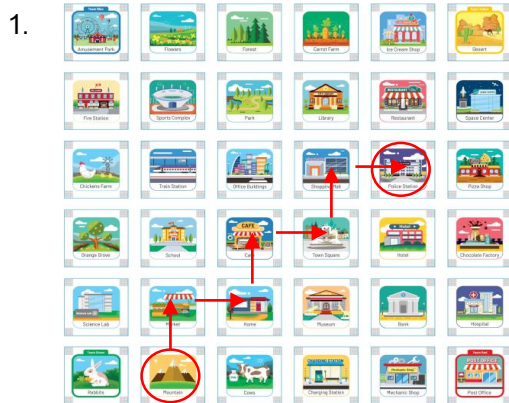


Example 2



MISSION : let's use Repeat

The learners use the “Repeat” coding tag to obtain the following movement patterns.



Activity 4 - More Repeat and Repetition

Purpose of the activity

This activity gets student to further practice repeat and looping commands so that they form a better understanding and develop skills to solve problems using loops.

Material



Teaching Steps

1. Set up students to work in groups or individually using “paper console”
2. Work through the activities and use “Repeat” coding tag to solve the problem.

Example Activity



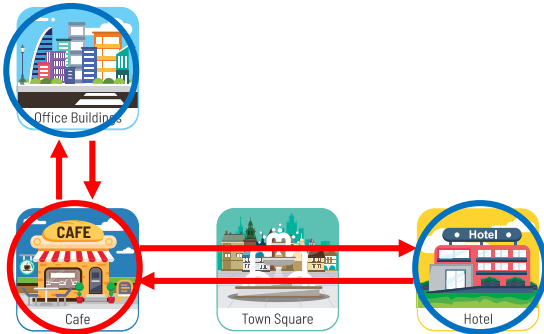
Mojobot receives an order to pick up a package from the Train Station and deliver it to the Market and then go back to the Train Station and wait 2 seconds. Then Mojobot shall pick up a new package and deliver it to the Flowers, then go back to Train Station and wait for 2 seconds. Mojobot shall repeat all of this 3 times.

Note : Start off facing north.



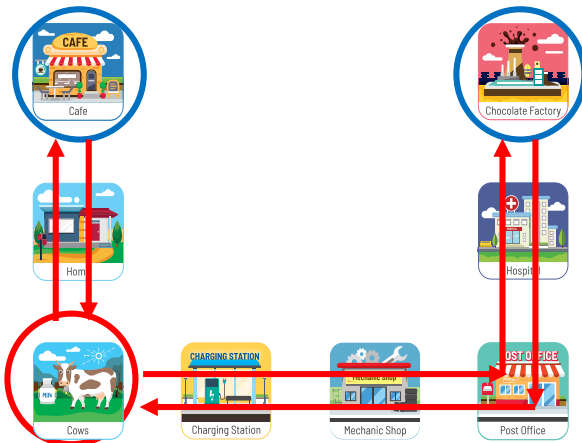
MISSION : Let's use Repeat!

1.



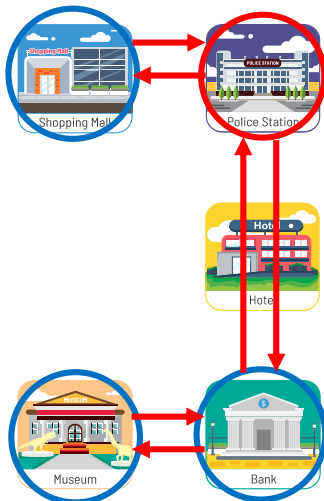
Mojobot works part-time at the Cafe and has to deliver goods to the customers at the Hotel. After delivery Mojobot returns to the Cafe. Next up Mojobot has to deliver goods to customers at Office Building and returns to Cafe again. Work is busy and Mojobot does this all the day long! (Hint: use "repeat infinity")

2.



Mojobot opens a dairy farm at Cows, it delivers cow's milk to the Cafe and comes back to pick up more milk at Cows to deliver it to the Chocolate Factory and returns back to Cows again. Mojobot does all of this 5 times a day.

3.



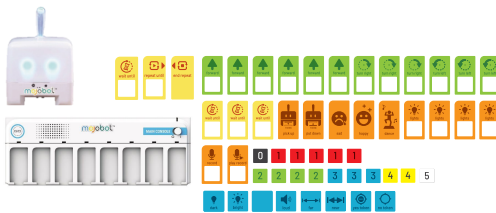
Officer Mojobot has to depart from Police Station to inspect the area around the Shopping Mall before returning to the Police Station and continue patrolling around the Bank and the Museum, when it's done, Mojobot returns to rest. Do all of this 3 times a day.

Activity 5 - Mojo Shy Bot

Purpose of the activity

This activity introduces two new coding commands, the “wait until” command and the “near” Boolean sensor input. Students will learn how to use conditional sensor input to create an autonomous robot that is very shy!

Material



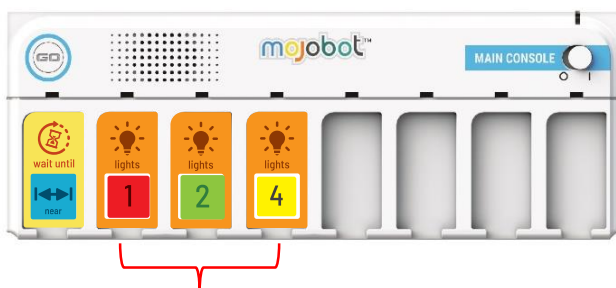
Teaching Steps

1. The instructor explains the mission of creating a shy bot robot.
2. Have students decorate a shybot robot to be a shy robot.
3. The instructor demonstrates with example of how to use “wait until” command in combination with “near” sensor input.

Example Activity

Activity 1

Learn to use **Wait until** with **Near**



1.1 Place Mojobot anywhere in the

1.2 Push Go button

1.3 Look at the light on Main Console

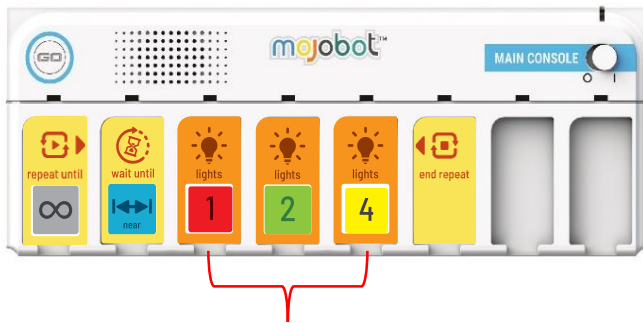
1.4 Take your hand close to Mojobot's face and see the result

Here, you can use any coding tags in “Movement” and “Action” category.

Example Activity

Activity 2

Use loop with **Wait until** and **Near** to make Mojobot work automatically.



Here, you can use any coding tags in “Movement” and “Action” category.

1.1 Place Mojobot anywhere in the map

1.2 Push Go button

1.3 Look at the light on Main Console

1.4 Take your hand close to Mojobot’s face and see the result

1.5 Take your hand close to Mojobot again

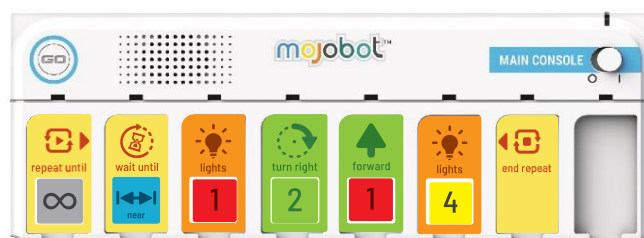
Explanation

From the second example, you can see that with an infinite loop, Mojobot has everytime you come near Mojobot, the tail lights will blink.

MISSION

The learners will write Shybot program. In this activity, encourage the students to be creative. Design the outward appearance using paper and stationary, design the gesture, sound and movement of shybot by using different tail lights, actions and recorded sound. Each of the shybot should have unique and fun characteristic.

Shybot program operates with “Wait until near” inside the loop that will continue looping in an infinite loop. Every times it starts a new loop, the command will wait at “Wait until near” and will wait until the sensor can read that there is something near. Mojobot is shy shall run away when someone comes near!



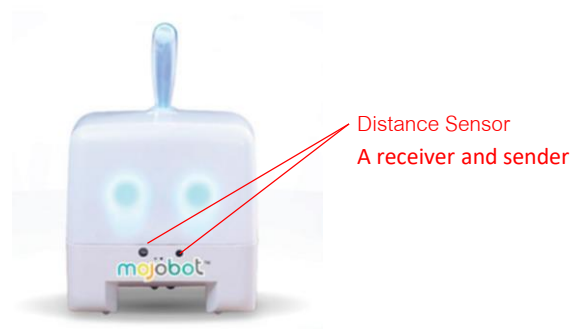
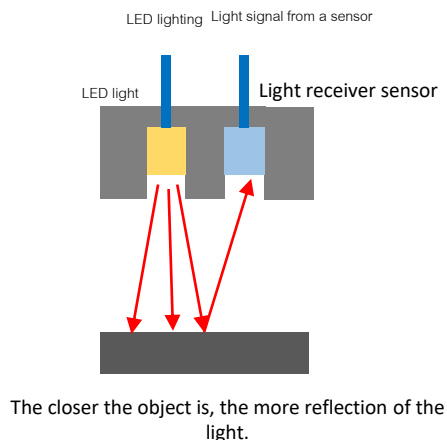
The distance sensor operation

The distance sensor is a sensor that is used to measure the distance between 2 objects. There are many types of distance sensors. Mojobot uses “Infrared Light” that emits from LED (Light Emitting Diode). When the infrared light hits an object, it reflects back into the Photodiode or Photoresistor which will change the light intensity into electrical signals. If there are high light brightness, it will create an electrical signal that has high voltage. This signal will sent to a computer that controls Mojobot.

The sensor allows us to write programs to check for the value of the sensors. This way we can indicate that the object is near or far. In other words, we can ask the sensors if the measured distance “is near” or “is far”. Try to put your hand in front of Mojobot’s face and then you should hear a sound. That is Mojobot responding to the value of “Near” received from sensor. Then try take your hand out from Mojobot and you should hears a sound from Mojobot again and that was responding to the value of “Far”.

Mojobot Distance Sensor:

- “Near” – Sensor receives the value within 1 blocks away, approximately around 3-14 cm in distance.
- “Far” – Sensor receives the value far more than 1 block, the distance is more than 15 cm.

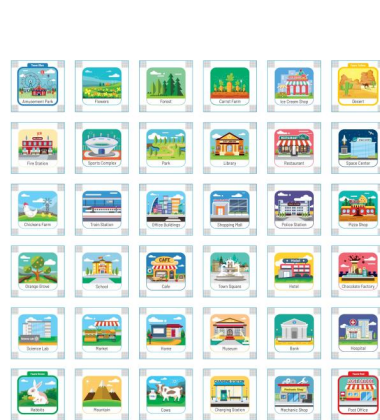
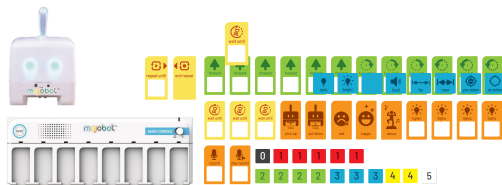


Activity 6 – Dance Bot

Purpose of the activity

In this activity we will create an automatic dancing robot. Students will achieve this by using “wait until” command and conditions from the sound sensor input.

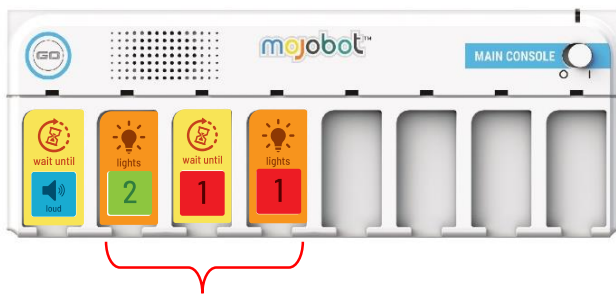
Material



Example Activity

Activity 1

Learn to use **Wait until** with **Sensor >>loud<<**



- 1.1 Place Mojobot anywhere in the map
- 1.2 Push Go button
- 1.3 Look at the light on Main Console
- 1.4 Clap your hand near to Mojobot

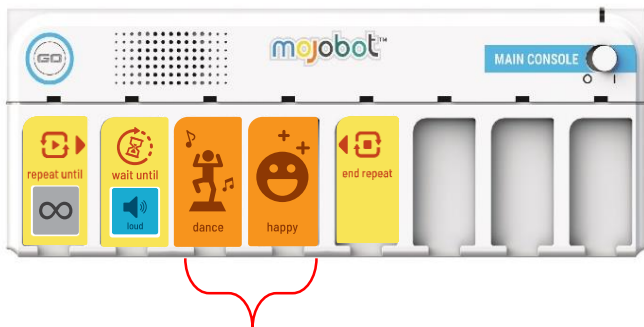
Here, you can use any coding tags in “Movement” and “Action” category.

MISSION

The learners will write Dance Bot program, give time to the students to find the solution themselves. If students are stuck, eventually the teacher can reveal and explain the correct answer.

In this activity try to inspire the learners to use their creativity. Start by giving students the task of transforming the appearance of Mojobot to become a Dance Bot. Students may use art equipment or anything they want such as paper, crayons, clear tape, tubes or crays, etc. In addition, lets the students create movement, lights sounds and actions of their owns Dance Bot to be colorful, fun and unique.

The DanceBot program will have a “Wait until loud” command inside the loop that will continuously loop forever. The command will wait and hold at “wait until loud” until the sound sensor inside Mojobot detects a “loud” noise, then command will move to the next one. After dancing the loop returns to the “wait until loud” again, so that Mojobot will carry on dancing if the loud music is still playing.



1.1 place Mojobot anywhere in the map

1.2 Push Go button

1.3 look at the light on Main Console

1.4 Clap your hand near to Mojobot

1.5 Clap your hand near to Mojobot again

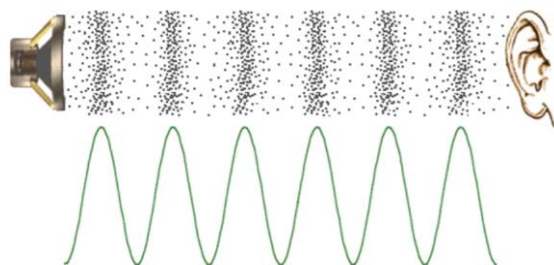
Here, you can use any coding tags in “Movement” and “Action” category.

Explanation

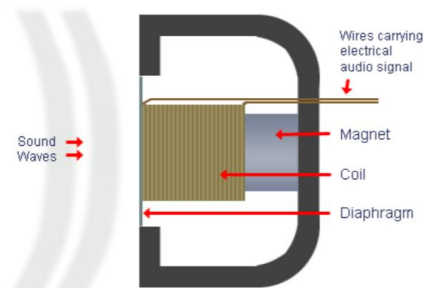
You can see that if the room is quiet, Mojobot will stay still, do nothing and the code will be hold at “Wait” command. Whenever there is a loud noise the robot will dance.

Sound sensor operation

Generally, the sound sensor is a sensor that transform the vibration of sound into an electrical signal. Actually the sound sensor has the same working principle as a microphone. The principle is to have a diaphragm that works similarly to a vibrating elastic band. Sound is caused by vibrations of objects and is transmitted through the collisions of molecules in the air until reaching the human ear or the sensor itself. The vibrating air will cause the diaphragm to vibrate, which will cause the coil to move in and out while the magnet is still. This event is call Electromagnetism or Electromagnetic, the movement of the wire (coil) through the stationary magnetic field will cause electric currents to flow in the coil. Finally, electrical signal in the coil will flow to the computer for processing. The larger the electrical signal, the louder the noise.



Sound waves are the vibrations of the molecules, whether solid molecules or liquids, such as air.



The principle of sound sensor function

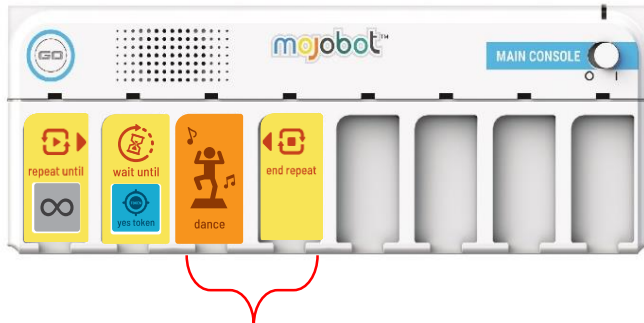


Microphone location

Example Activity

Activity 2

learn **Wait until** with Sensor >> **Yes Token** << (Automatic robot)



1.1 place Mojobot anywhere in the map

1.2 Push Go button

1.3 look at the light on Main Console

1.4 Try to put the Token under Mojobot

Here, you can use any coding tags in “Movement” and “Action” category.

Explanation

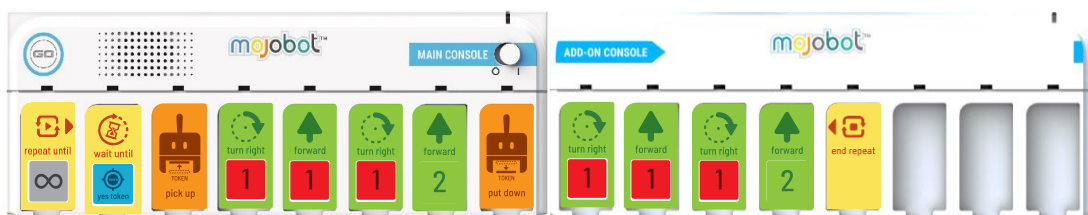
From Example 2, you will see that due to the “repeat infinity” loop Mojobot will dance every time it detects a Token underneath.

MISSION

Mojobot Delivery Bot

Mojobot is @Train Station facing the north.

Today is the happiest day of the year for Mojobot because the kind grandpa is coming to visit Mojobot and the family. Mojobot and family goes to the Train Station to pick up the kind grandpa. Upon arrival, Mojobot notices that kind grandpa has brought a lot of souvenirs with him. Mojobot quickly asks to help to carry all souvenirs back to Home. The tricky thing is Mojobot can only carry one item at a time. Mojobot will wait until grandpa passes an item and then take it home, then come back to the train station and waits until grandpa hand-over the next item. (Note: 7 items to take home, Gift, Eggs, Oranges, Books, Milk, Mail, Carrots)

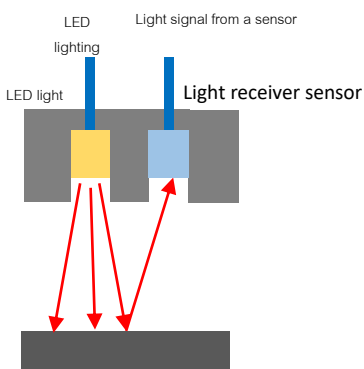


In the Mission, the students must write a program that makes Mojobot able to transport many Tokens in a multiple runs, also every time a loop finishes Mojobot has to be at the Train Station waiting for the next item to be handed over. To hand-over items, let students slowly slide a Token underneath Mojobot.

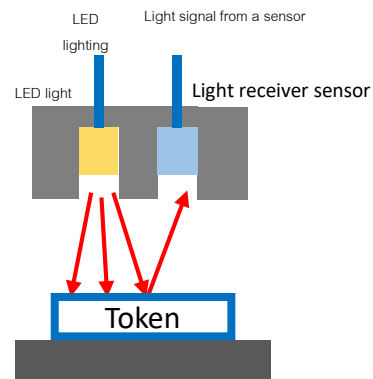
Token Sensor Operation

Mojobot detects that there is a Token or not by using distance sensors that are attached underneath the robot. The distance sensor uses the principle of infrared light emission and reflection. Here the distance detected is between greater than 1 cm and less than 1 cm. When a Token is present the sensor will detect a shorter distance and will give out a lower voltage.

Try to put the Token under Mojobot, should hear a sound showing that Mojobot the detect the inserted Token. To make sensing sensor work correctly, avoid playing in strong direct sunlight, as the powerful infrared rays from the Sun will make the sensors think that a Token is present.



When no Token is present, the intensity of the reflection light is less.



When a Token is present, the intensity of the reflected light is higher.



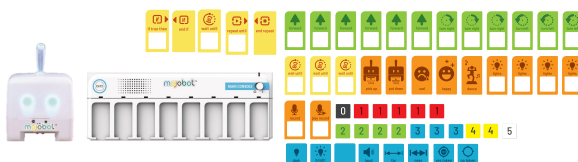
There are 2 pairs of infrared sensors underneath Mojobot. To detect that a Token is present, both pairs has to be activated.

Activity 8 - Mojo Smart Lamp

Purpose of the activity

The aim of this activity is to teach students about the “if statement” and the light sensor. Students will apply knowledge of these commands to create a smart lamp. Here the smart lamp is a lamp that turns on automatically when it’s dark, and turns off automatically when it is bright to save energy.

Material



Teaching Steps

1. The instructor explains the smart lamp mission.
2. The learner decorates Mojobot to become a Smart Lamp as desired by using art equipment such as colored paper, clay, tape, crayon, etc.
3. The instructor demonstrates the use of “if statement” coding tags along with sensor inputs “bright” and “dark”.
4. Let the learners code the program to complete the the smart lamp mission.
5. Let the learners present their work to their class mate.



Example Activity

Activity 1 learn >>if true then<< with sensor >>Dark<<



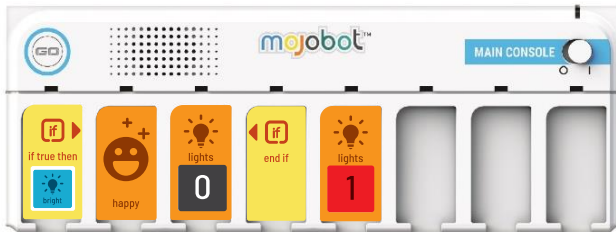
- 1.1 place Mojobot anywhere in the map
- 1.2 Take cardboard to cover the light sensor on top of Mojobot and press Go button
- 1.3 Remove cardboard on top of Mojobot and press Go button again

You will see: if its dark the program will run these commands 

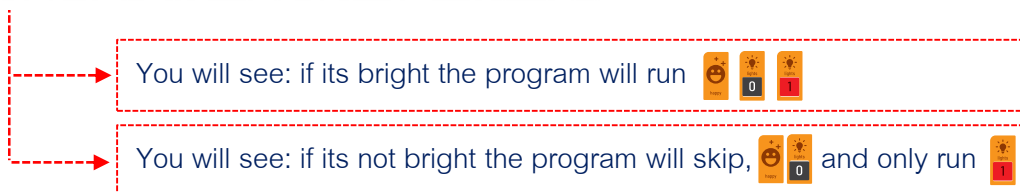
You will see: if its not dark the program will skip  and run only 

Example Activity

Example 2 learn >>if true then<< with Sensor >>Bright<<




- 1.1 place Mojobot anywhere in the map
 - 1.2 Press go button (put Mojobot in open place)
- Press go button again

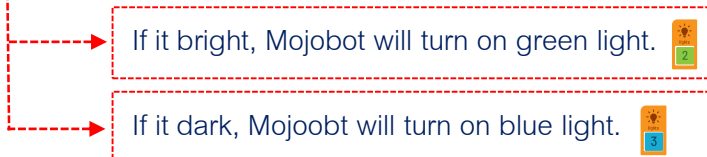


Example 3 practice using >>if true then<< with Sensor >>Bright<< and >>Dark<< (automatic robot)



- 1.1 Run the code shown.
- 1.2 Use your hands or other objects to block light going to the light sensors on top of Mojobot.
- 1.3 Remove hands or other objects so that light can reach the light sensor on top of Mojobot.

 You will see Mojobot choose his decision



Light Sensor Operation

The measurement of light can use electrical components and circuits that convert the intensity of light into an electrical signal. This can be done using components such as a photodiode or photoresistor or phototransistor.

Normally, transistor, diode or resistor are general electrical circuit components. But the photodiode is a special type of diode which has electrical properties that vary with the intensity or brightness of the light. Usually, the brighter the light, will lead to a higher voltage of electrical signal. The light sensor will work on visible light frequency spectrum, as opposed to infrared spectrum frequencies in infrared sensors.



Photo-diode

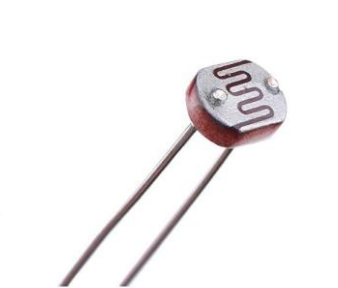


Photo-resistor



Photo-transistor



If you look carefully you can see a black ring silhouette. This is the light sensor attached inside, underneath Mojobot's top cover.

Activity 9 - Mojobot's Explorer Token

Purpose of the activity

This activities builds up understanding of “if statement” by applying to Token exploration tasks. The examples in this activity will explicitly show the if-statement as a fork in the decision making paths.

Material

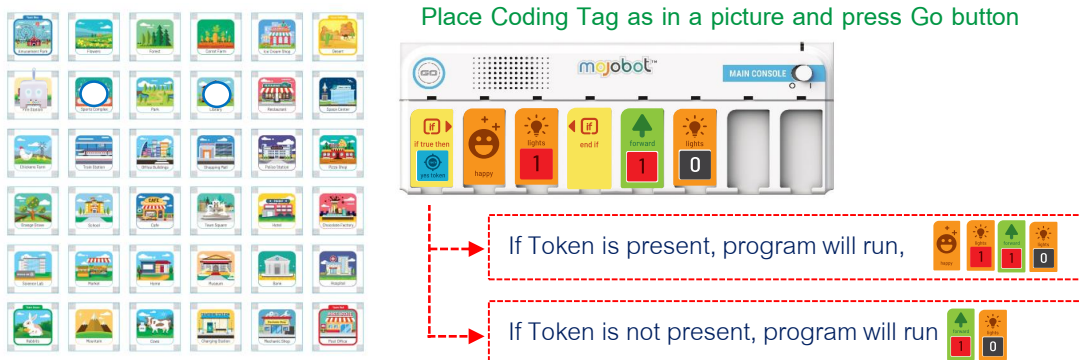


Teaching Steps


1. The instructor demonstrate “if statement” coding tags along side Token sensor inputs.
2. Let the students work to complete the mission activities utilizing “if statement” and token sensors.


Example Activity

Example 1 Place Mojobot @ Fire Station facing to Sports Complex. Also place Tokens as shown.



Place Coding Tag as in a picture and press Go button

If Token is present, program will run, 

If Token is not present, program will run 

*** From Example Activity 1, the instructor can press the Go button repeatedly 3-4 times so that students can observe both cases where there is a Token present and not present.

Example Activity

Example 2 Place Mojobot @Home facing to the north of the map.



Place Coding Tag as in a picture and press Go button



If token is present, Mojobot will head to the library.

If token is not present, Mojobot will head to the pizza shop.

*** Try this code with two scenarios, with token present underneath and without token. Let students observe and discuss the results.

Mission to build understanding

1. It is the end of School day and Mojobot travels from School back to home. When Mojobot arrives home, if there is a Pizza, Mojobot will pick it up and eat, and then dances happily, but if there is no Pizza Mojobot would still feel happy, because there is no homework today.
2. Mojobot is at the Market checking that if there is a Picnic token he will pick up and go to the @Market, but if there is no Picnic available, he will go for nothing to eat @ Restaurant instead.

Mission builds special understand using 2 pieces Add-on

3. Mother asks Mojobot to check for a mail parcel at the the Post Office. Mojobot leaves Home heading out to the Post Office. If there is Mail, pick up the Mail back to home and put it down, then tell his mother that "this is your Mail". But if it is no Mail come back home to tell the mother, "there is no Mail mom". (Note: use the record function, user must record two different tracks prior to implementing the program)

Activity 10 – Bull Robot

Purpose of the activity

In this activity students are takes to use knowledge of “if statement” to design a Bull Robot. This is a robot that will charge down anyone and anything than comes near.

Material



Teaching Steps

1. The instructor explains the missions of Bull robot. Bull robot will look for anything in front and run to hit it.
2. Let the learners decorate the robot Mojobot become bull bot by using art equipment.
3. Demonstrate using >>if true then<< with Sensor >>Near<< and >>Far<<
4. Let students a way to write a bull robot program in their own ways.
5. Let students present their work to their class mate.

Example Activity

Explanation Teach and demonstrate how to use the command >> If True Then << with the sensor input >>Near<<.

Example 1 Test the command >>if true then<< with Sensor >>Near<<



put Coding Tag as in a picture and press Go



If there is an object near in front of Mojobot, Mojobot will dance.

If there is no object, Mojobot will not dance.

*** Demonstrate both scenarios with object near, and without to the students.

Example

Explanation Teach and demonstrate the learners how to use of the command >> If True Then << with the sensor input >> Far <<

Activity 2 Test the command >>if true then<< with Sensor >>Near<<



put Coding Tag as in a picture and press Go button



If the front-reading phase was far , Mojobot will dance and finally "happy".

If not far, Mojobot will not "dance" and do "happy".

*** Demonstrate both scenarios with object near, and without to the students.

Mission

Explanation The bull robot will continually turn around until it sees any object. If it sees a person or any object the bull bot will rush to it and charge down immediately.

Activity 3 Program Code Bull Robot



put Coding Tag as in a picture and press Go button



If the distance is near the robot, Mojobot will be charging.

If the front is read far, Mojobot will turn right.

*** Guide the learners to adjust the appearance and the behavior of Bull Robot to be unique by adding sounds and lights to their Bull Robot.

Activity 11 – Mojobot Dodging Explorer

Purpose of the activity

The aim of this activity is to let the learners practice their design skill and program a robot that can avoid hitting object. The Mission is to make Mojobot move forward and explore until finding an obstacle or dead-end. After detecting the dead end, Mojobot shall turn around explore in the other direction. In this activity students shall use “if statement” and the distance sensor to complete the mission.

Material



How to start...

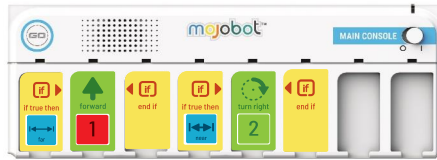
1. The instructor explains the mission: Make robot move forward until finding an obstacle then turn back and explore another direction. If another obstacle is found then turn around and repeat. The result is Mojobot will move between two obstacles.
2. The instructor demonstrate with an examples of how to use “if statement” with “near” and “far”.
3. Students carry out the dodging explorer mission.

Example Activity

Activity 1 Place Mojobot @Park facing to Office Buildings and place obstacles as shown.



Place Coding Tag as in a picture and press Go button



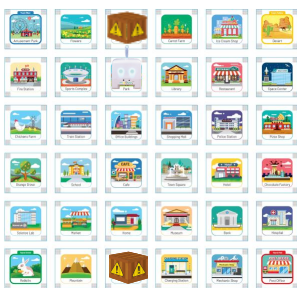
If there is no obstacle front, Mojobot will walk forward.

If there is an obstacle, Mojobot will make a u-turn.

*** Press go repeatedly to cover cases where both cases with obstacle in front and without obstacle in front.

Mission

Mojobot will move forward and explore until it finds an obstacle and dead end. Then Mojobot will turn around and continue exploring in the opposite direction. Again Mojobot will continue exploring until an obstructed dead end is detected, Mojobot will then turn around and repeat exploration the the opposite direction.



Place Coding Tag as in a picture and press Go button



To see that if the front is no obstacle, Mojobot will move forward.

To see that if the front is obstructing, Mojobot will return after turning to automatically dodge the obstacles.

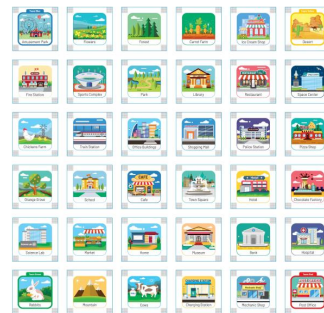
*** Let the learners program Mojobot to be unique, by using light, sound and emotions. For example turn on green light when the front is clear and turn on red light when there is a dead-end.

Activity 12 - Mojobot Sweeper Cleaner

Purpose of the activity

This activity aims to enhance and advance students understanding and ability to apply “if statement” commands in conjunction with sensor inputs to obtain the desired autonomous behavior. Here the task is to program Mojobot to automatically sweep the designated area of town to be totally free of obstacles.

Material



Teaching Steps

1. Explain the Mission to the students.
2. Get the students to attempt the mission. The classroom can be arranged into groups or students can work individually and plan using the “paper console”.

MISSION

The Mission of Mojobot is to remove all obstacles in the green area into the yellow area. The obstacles are randomly placed and can be anywhere in the green area. Students will not know before hand where the obstacles are placed and the robot has to deal with any situation presented.



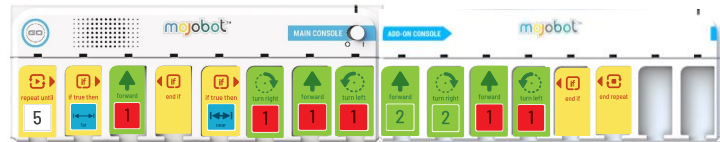
*** The learners can use a variety of movement to clear the traffic path for convenience.

SOLUTION

Mojobot clears the path by moving to the side of the obstacle then drives forward to push the obstacle into the yellow area.



Example of putting Coding Tags to solve a problem



The mission is complete when Mojobot moves all obstacles from green area to the yellow area.

EXTRA MISSION

Let the students work together to remove all obstacles from the East side of the map. This can be done by using three Mojobots to work together as a team. The first Mojobot removes obstacles from green to yellow area, second Mojobot moves obstacles from yellow area to blue area, and the 3rd Mojobot moves obstacles from blue area outside of the map.



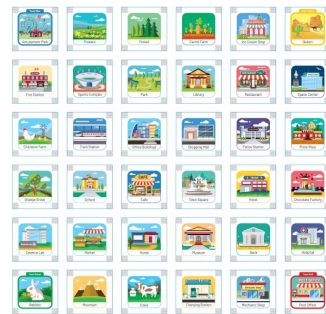
*** Think about the order and sequence of actions required to make this work. Work must be first done on the green area, followed by yellow area and lastly blue area.

Activity 13 – Repeat Until Part 1

Purpose of the activity

This activity aims to introduce and teach students about conditional loops. This is done by using the “Repeat Until” command together with sensor input conditions.

Material



Teaching Steps

1. Teacher demonstrates and explains the operation of conditional loops and “Repeat Until” command together with sensor inputs.
2. Divide the learners into a groups or let students work individually to complete the activities.

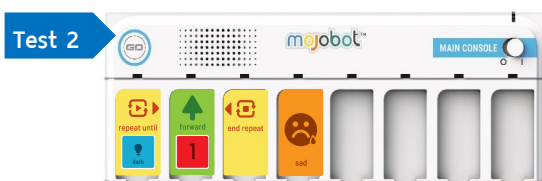
Example Activity

Try out the code shown here. Observe what happens when covering up the light sensor.

(Note: For this activity avoid playing in direct sunlight, as the activity requires the user to cover up the light sensors to make Mojobot sense dark. In direct sunlight it is impossible to cover up the light sensor enough such that they sense dark.)



Run the program, while it is bright, you will see that Mojobot loops around and continually move forward. If you cover up the light sensors then, the program will exit the loop and end, making Mojobot stop moving.




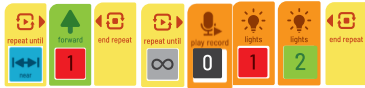


In this second example we will see the same behavior as the first example, except that this time once you cover up the light sensor so that the code exit the loop, Mojobot will display “sad” emotion before the end of program.

Explanation

Every time the program runs the “repeat until” command, it will check for the sensor input condition. If the condition is true, such as dark in this case, then the program will exit the loop, if not the program continues running the “repeat” loop.

MISSION







In these activity missions students must use conditional loops to solve the problem. This means students have to use the “Repeat Until” coding tag together with sensor input coding tags.

MISSION	Coding Tags Pattern
<p>1. Mojobot is @Home facing North and moves forward until reaching an obstacle. Then Mojobot will speak repeatedly “dead-end found can not continue”.</p> 	 <p>The code will repeat in the first loop. In one loop Mojobot will move forward 1 block until an obstacle is detected. Then the code will exit the first loop and moves into the second loop where Mojobot repeatedly plays the recorded sound.</p>
<p>2. Mojobot is @Town Square, facing the north. It is spinning around itself, but when an object is detected, Mojobot will flashing multicolor light. If object is removed then Mojobot will resume spinning around.</p> 	 <p>Here are two nested loops, one inside another. The outer loop is an infinite loop where Mojobot will turn left once in each loop cycle. If Mojobot detects far then it will exit the inner loop. Therefore the code will be stuck in the inner loop only if Mojobot detects near.</p>

Activity 14 – Repeat Until Part 2

Purpose of the activity

This activity aims to give practice and improve students ability to use and apply conditional loops to solve problems.

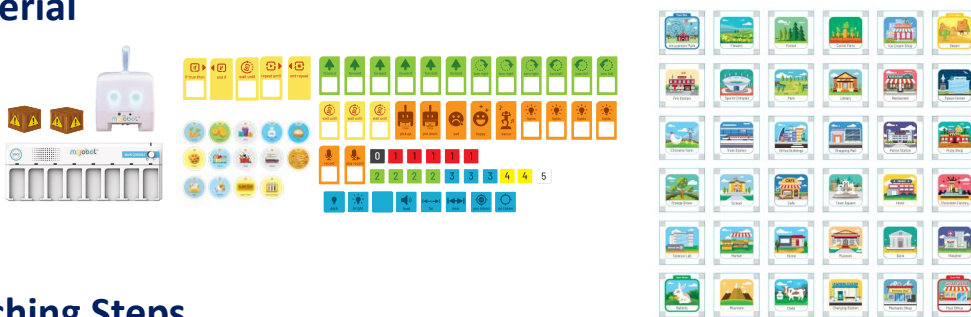
MISSION	Coding Tags Pattern
<p>3. Mojobot is @Town Square, facing the north and having fun with dancing every times he hear the music being played. If there is no music then Mojobot shall be sad.</p> 	 <p>In this code example, there are two nested loops. The outer loop will makes Mojoboot “dance” once each cycle. But if there is no sound, the program will get stuck inside the inner loop and will do “sad” continuously, until it is loud, then the program will exit the inner loop.</p>
<p>4. Mojobot is @Market facing east and heads out to explore and search for Tokens. If Token is found, pick it up, dance, and repeatedly blink tail light. Randomly put place the Token so that students do not know the Token location before hand.</p> 	 <p>There are two loops here, 1st loop and then 2nd loop. In the 1st loop Mojobot will move forward until a Token is found. Then the code will exit the 1st loop. Mojobot will Pick the Token and dance. Then the code enters the 2nd loop and repeat blinking lights.</p>
<p>5. Mojobot @Market facing east. Show students the code shown below. The task of the studentws is to place 3 Tokens that will enable Mojobot to come back home when the code is run.</p> 	 <p>Place 3 Tokens as shown on the map here. Mojobot will move to all Tokens, and turn left once detecting the Token.</p>

Activity 15 - Mojo Sub-Routine

Purpose of the activity

The purpose of this activity is to introduce students the use of sub-routines and functions. Students learn that they can create their own sub-routine (also called function) which can really help, organize, reduce and simplify coding. The use of sub-routine is about finding patterns and repetition in the code which can be defined as a sub-routine, such that we can call a set of actions with simply 1 command.

Material

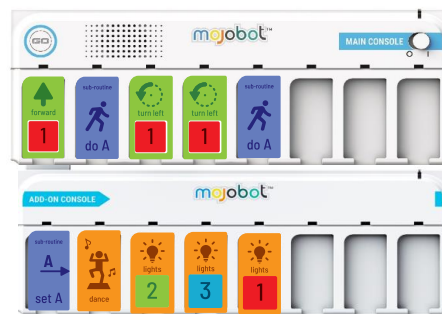


Teaching Steps

1. The instructor demonstrates and explains the use and operation of sub-routines.
2. Allow students to work in groups or individually to complete the mission activities.

Example

Connect Add-on Console as Sub-Routine



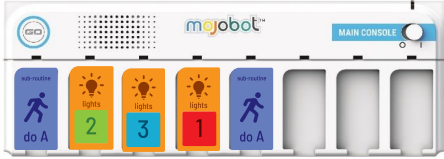
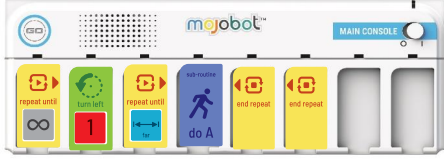
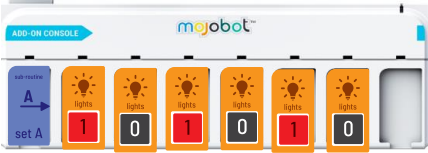




Using Do A and Set A

Result

1. Mojobot move forward 1 Step
2. Mojobot dance and flashing green, blue and red light.
3. Mojobot turn left once.
4. Mojobot turn left once.
5. Mojobot dance and flashing green, blue and red light.

Mission Activity

Given the code shown below. Let the students describe the sequence of actions Mojobot will carry out. This activity aims to get students to practice their understanding of reading codes with sub-routines.

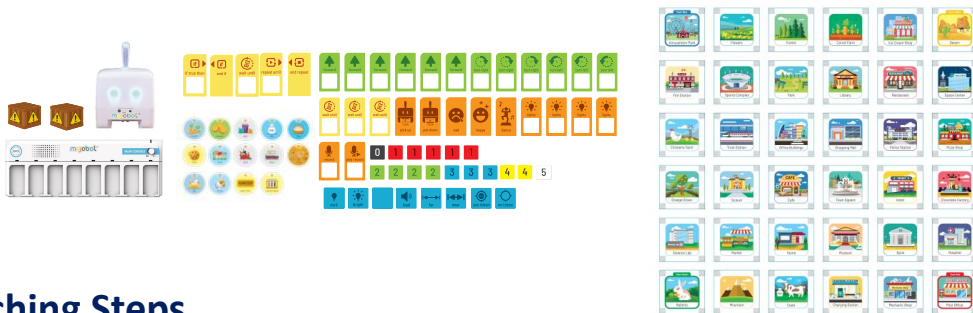
Main Console	Add-on Console
<p>1.</p> 	
<p>2.</p> 	
<p>3.</p> 	
<p>4.</p> 	
<p>5.</p> 	

Activity 16 - Super Receptionist Robot

Purpose of the activity

This activity is an activity that students will create a receptionist robot using the knowledge of using Sub-Routine. Challenge students to find the repeated pattern in the code that makes sense to be defined into a sub-routine.

Material



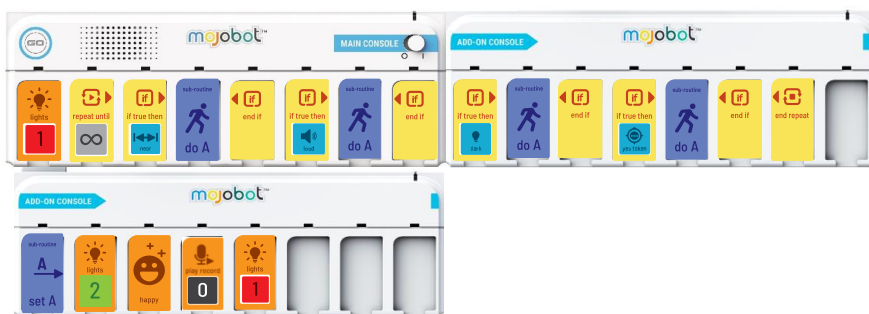
Teaching Steps

1. The instructor explains the mission
2. Let the learners decorate Mojobot to become receptionist robot by using paper. Color and tape etc.
3. Let the learners start programming Mojobot.
4. Let the learners present their work to their class mate.



MISSION

Explanation In this mission Mojobot is at the hotel to help out Grandma to receive guests. Mojobot's duty is to greet all guests by saying for example, "hello welcome to the hotel, hope you feel comfortable and enjoy your stay". Mojobot will greet any guest that comes near, or when spoken to, or when receiving a Token tip, or when patted on the head (light sensor).



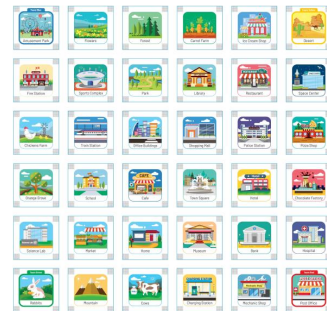
Let students figure out which part of the code makes sense to be defined as a sub-routine. This is generally the code that gets repeated often. In this case it is the greeting actions that is arranged into Sub-Routine A.

Activity17 – Rescue Robot

Purpose of the activity

The purpose of this activity is to get students to apply their knowledge of sub-routines to solve real problems. The theme here is that a natural disaster, wildfire, is occurring on the outskirts of east side of town. Mojobot shall help the evacuation by moving items from the eastside to the west side of town.

Material



How to start...

1. The instructor explains the mission
2. Let the learners decorate Mojobot to become firefighter.
3. Let the learners start programming the robot.
4. Let the learners present their work to their class mate.

MISSION

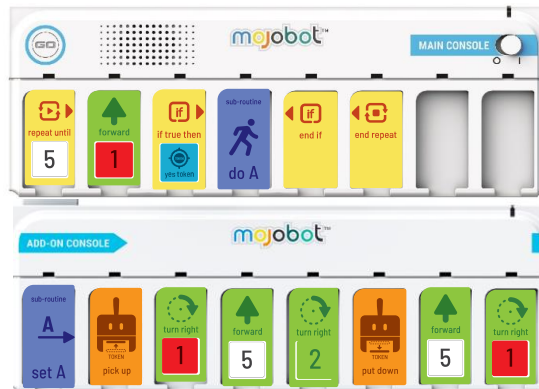
Explanation Unfortunately some time has natural disasters such as forest fires, flooding and earthquakes occurs. In this Mission Mojobot will help evacuation of people and things from the east of the City to the west.



Wildfire is on the east of the City

All a Tokens may appear at randomly any spot of the eastern edge of the city. It is Mojobot's job to carry all items from east side to west side within one program run!

Let the learners study the problem and decide which repeated part of the code makes sense to be organized into a sub-routine. Here we have arranged the pick-up and delivery of a single Token from east to west and the the Sub-routine section.



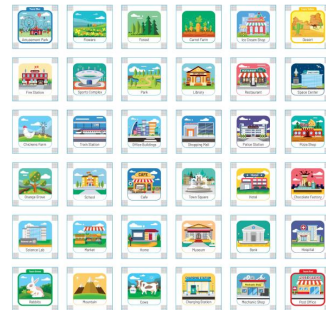
In this example, Mojobot will move forward 5 times in a loop. After each forward movement, Mojobot will examine if there is a Token or not. If found Mojobot will pick it up and bring it to the west of the city and return to the previous location where it found the Token. The process repeats 5 times and all Tokens shall be moved from east side to westside.

Activity 18 - Super Mission Challenge

Purpose of the activity

This activity is the ultimate challenge that will really test students ability to apply coding skills to solve problems. Students can use all of their knowledge and use any type of coding tag to tackle the task. No rules about how may coding tags or how many coding slots use. Just complete the Misision and earn maximum points. Bonus point to the team that also uses the least coding slots.

Material

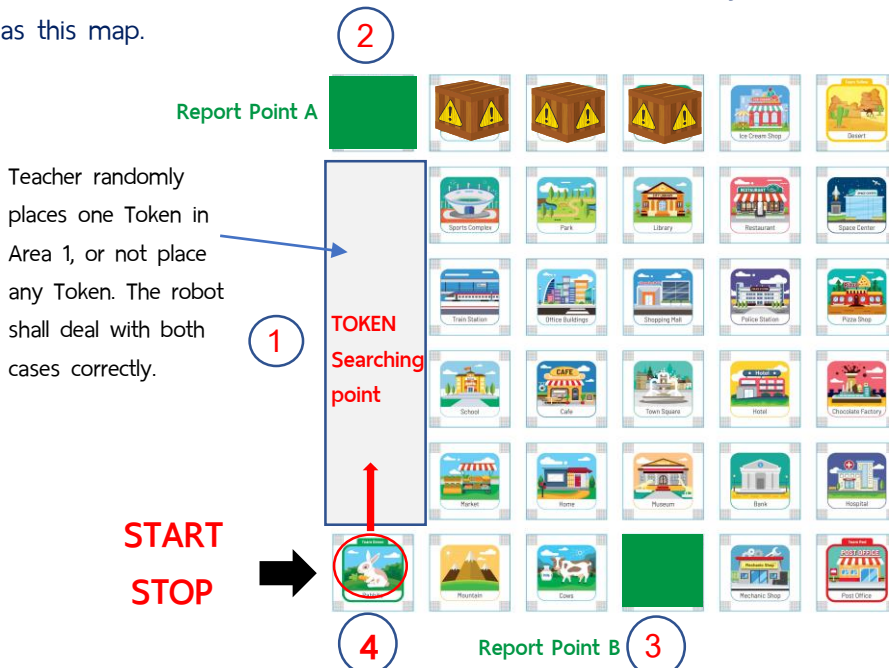


Teaching Steps

1. The instructor divide the learners in to a group of 4-5 people and change a map to the moon map.
2. Let the learners in each group plan to placing Coding Tag to conquer the following mission.

MISSION

Explanation Let the learners write the code that make Mojobot does the mission as described and as this map.



Explanation The Mojobot robots must start at the Rabbits and face north. Total 8 points available if all tasks in the mission is successfully completed.

1. Mojobot dances on top of a Token that is found in Area 1. Mojobot shall not dance when there is no Token in Area 1. - Receive 1 point
2. Mojobot reports at Point A. Report with green tail light if a Token was found in Area 1, or report with red light if no Token was found in Area 1. - Receive 1 point
3. Move all 3 obstacles out of the map area. - Receive 1 point per box (Max 3 points)
4. Move to Area number 3 (also known as Report Point B). - Receive 1 point
5. Wait for the order from officer, officer will give the signal by patting on top of Mojobot's head - Receive 1 point
6. Return back to starting point - Receive 1 point

MISSION Answer

Presented here are two solutions of solving the mission Please note that there are many more ways to achieve this.

Solve a problem without using Sub-Routine



Or using Sub-Routine



** There are multiple solutions to this mission. Allow students to explore and find there solutions. At the end of the class let students present their solutions to each other and allow for classroom discussion on the benefits of each method.