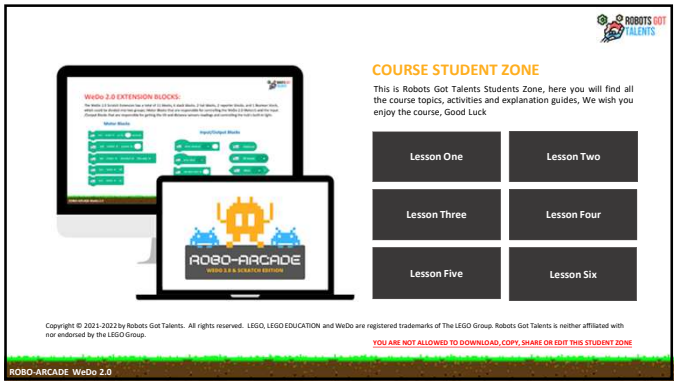
COURSE STUDENT ZONE
This is Robots Got Talents Students Zone, here you will find all the course topics, activities and explanation guides, We wish you enjoy the course, Good Luck
Lesson One
Lesson Two
Lesson Three
Lesson Four
Lesson Five
Lesson Six
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ROBO-ARCADE WeDo 2.0


ROBOTS GOT TALENTS
ROBOTS GOT TALENTS™ CLASSROOM COURSES
This Course is created and published by Robots Got Talents, Robots Got Talents is a volunteer-based Educational Platform founded in 2017 aiming to spread Robotics and Coding Knowledge all over the world by creating and publishing online free STEM educational content for Educational institutes and Individuals. In 2020 RGT had a total of 523 Classroom Events in 80 countries. Learn More About RGT


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THIS COURSE IS AVAILABLE ON:

CLASSROOM ROBOTICS
BY ROBOTS GOT TALENTS

ROBOAPP
ACTIVATING CREATIVITY MODE

ROBOTS GOT TALENTS

COURSE INTRODUCTION:

ROBO-ARCADE [WeDo 2.0 Edition] is a Robots Got Talents classroom course for elementary school students made in cooperation with Mi 2 Tôm YouTube Channel. Throughout this course participants will learn the basics of robotics, coding and game development as they create their own Arcade Games, using LEGO Education WeDo 2.0 Educational Robotics Platform and SCRATCH 3.0.

ROBO-ARCADE Course consists of six lessons that cover all the topics mentioned below in addition to ten building/programming exercises and Projects:

- Introduction to Robotics
- Robots Characteristics
- WeDo 2.0 Introduction
- WeDo 2.0 Main Parts
- WeDo 2.0 Building Pieces
- Introduction to Algorithms
- Basics of Programming
- WeDo 2.0 Programming
- SCRATCH Studio UI
- SCRATCH 3 Blocks
- Blocks categories
- Useful SCRATCH Blocks
- WeDo 2.0 Extension
- Flowchart
- History of Robotics
- Motor Blocks
- Pseudocode
- Input/Output Blocks

ROBO-ARCADE WeDo 2.0

LESSON ONE:

- **Introduction to Robotics** [Book Page/s: 3-4]
- **Robots Characteristics** [Book Page/s: 4]
- **WeDo 2.0 Introduction** [Book Page/s: 9]
- **WeDo 2.0 Main Parts** [Book Page/s: 11]
- **Building Exercise One**
- **Introduction to Algorithms** [Book Page/s: 14]

WHAT IS THE FIRST THING THAT COMES TO MIND WHEN YOU THINK OF A ROBOT?

For many people it is a machine that imitates a human—like the androids in Star Wars, Terminator and Star Trek: The Next Generation. However much these robots capture our imagination, such robots still only inhabit Science Fiction. People still haven't been able to give a robot enough 'common sense' to reliably interact with a dynamic world. However, some people all over the world are working on creating such humanoid robots.

The type of robots that you will encounter most frequently are robots that do work that is too dangerous, boring, onerous, or repetitive. Most of the robots in the world are of this type. They can be found in auto, medical, manufacturing and space industries. In fact, there are over a million of these types of robots working for us today. but It is totally wrong to define Robots as machines that do our work or help us finish dangerous tasks, like many simple machines, could just do that for instance, Microwave heaters deals with harmful microwaves and they are not counted as Robots and the crane lifts heavy objects which a human could never deal with and they are defined as robots

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A ROBOT HAS THESE ESSENTIAL CHARACTERISTICS:

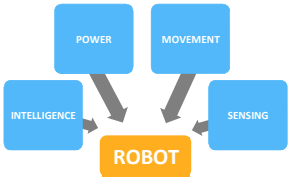
As strange as it might seem, there is no standard definition for a robot. However, there are some essential characteristics that a robot must have and this might help you to decide what is and what is not. It will also help you to decide what features you will need to build into a machine before it can count as a robot.

SENSING: Using the Sensors the robot should be able to sense its surroundings by one or more methods

MOVEMENT: Using Motors the robot should be able to move in its environment

POWER: Using the Power Source the robot should be able power itself

INTELLIGENCE: Using the Microcontroller (Robot's Brain) the robot should be able to take decisions according to its program



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ROBOTICS CHARACTERISTICS:

SENSING: First of all a robot should be able to sense its surroundings It would do this in ways that are not similar to the way that we sense our surroundings, but robots need sensors to do that. Giving your robot sensors as light sensors (eyes), touch and pressure sensors (hands), chemical sensors (nose), hearing and sonar sensors (ears), and taste sensors (tongue) will give your robot awareness of its environment.

MOVEMENT: Moreover a robot needs to be able to move around its environment. Whether rolling on wheels, walking on legs or propelling by thrusters or even moving a claw. To count as a robot either the whole robot moves or just parts of the robot moves.

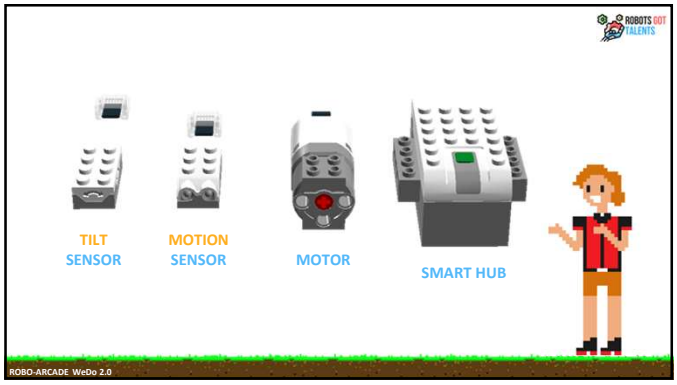
POWER: Also a robot needs to be able to power itself. It might be solar-powered, electrically-powered, or even battery-powered. The way your robot gets its energy will depend on what your robot needs to do.

INTELLIGENCE: Finally A robot needs some kind of Intelligence this is where programming enters the pictures, a programmer is a person who gives the robot its 'smarts.' The robot will have to have some way to receive the program so that it knows what it is to do.

ROBO-ARCADE WeDo 2.0


WeDo INTRODUCTION:
The LEGO® EDUCATION WEDO robots may not be a type of robots that will go buy the breakfast every day or take care of your grandfather, but it could teach many things that will help you in your life from computational thinking to building LEGO® models. Since the creation of the MINDSTORMS Platform in 1998, LEGO Have tried to create an Educational Platform for Elementary School Students that would help them learn STEM in easy and fun ways.
The first Version of WEDO (9580) was released on 2009, it included two sensors, one motor and a USB Smart Hub. In 2016 WEDO 2.0 (45300) was released, with upgraded sensors, motors and Smart Hub.
ROBO-ARCADE WeDo 2.0


LEGO EDUCATION WEDO 2.0
The WEDO 2.0 Core Set includes 280 LEGO Pieces in addition to a two WEDO sensors (tilt sensor and motion sensor), one WEDO 2.0 Motor and a programmable Smart Hub that connects to a computer or tablet via Bluetooth. The Smart Hub is powered by either two AA batteries or a rechargeable battery pack. After recognizing the Set contents we can say that WEDO 2.0 is a robotic Set, as it includes all the 4 features of robots; Sensing, Movement, Intelligence and Energy.
INTELLIGENCE
WEDO 2.0 Smart Hub
SENSING
Motion Sensor
MOVEMENT
WEDO 2.0 Motor
POWER
WEDO 2.0 Battery
ROBO-ARCADE WeDo 2.0


TILT SENSOR
MOTION SENSOR
MOTOR
SMART HUB
ROBO-ARCADE WeDo 2.0

MAIN WEDO 2.0 PIECES:

SMART HUB
The Smart Hub acts as the brain of your robots, enabling the WEDO sensors and motors to come to life, by connecting them into the two available ports, which do transmits data between the programming device and the WEDO 2.0 Set using the WEDO 2.0 Software and Bluetooth, For Powering your Robot, The Smart Hub requires two AA batteries or the Rechargeable Battery.

MOTORS
A motor is an electrical machine that converts electrical energy distributed by the battery in the Smart Hub into mechanical energy. The WEDO 2.0 Core Set includes one motor, that could either by plugged into any of the ports in the Smart Hub.

MOTION SENSOR
The Motion Sensor can detect objects up to about 15 cm away. The motion sensor emits Infrared rays then measures distance by calculating the time it takes for an IR ray to hit an object and return.

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MAIN WEDO 2.0 PIECES:

SMART HUB
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MOTORS
A motor is an electrical machine that converts electrical energy distributed by the battery in the Smart Hub into mechanical energy. The WEDO 2.0 Core Set includes one motor, that could either by plugged into any of the ports in the Smart Hub.

TILT SENSOR
The WEDO 2.0 tilt sensor detects the movement of your robot, its rotation and vibration, it could detect changes within six different positions: Tilt Right, Tilt Left, Tilt Up, Tilt Down, No Tilt and Shake.

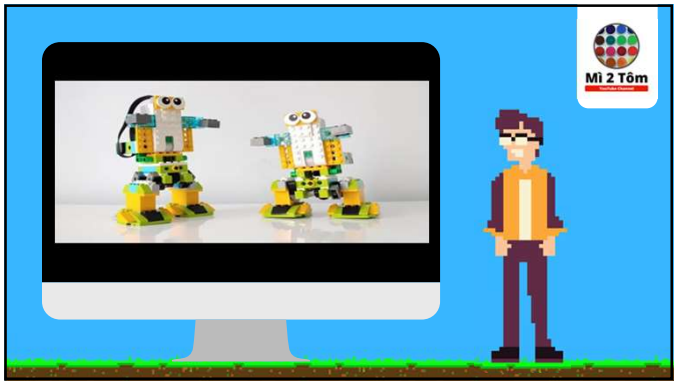
ROBO-ARCADE WeDo 2.0

BUILDING EXERCISE 1

It is now time for your first building exercise. In this course you will not use the usual PDF Building Instructions, but you will follow the awesome YouTube Video Tutorials provided by Mi 2 Tôm, to Build your WeDo 2.0 Bots. In this exercise you will build the WeDo 2.0 Walking Bot V1.

The Building Exercise tutorial is included in the next page, if you were not able to follow up with the video you can slow up the YouTube video by (Settings > Playback Speed).

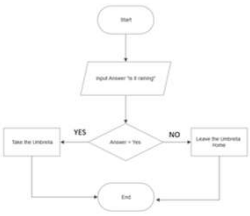
RoboApp-Android users please long press the full screen button, to be able to access the downloadable files if needed.



ALGORITHMS:

Of course, a robot won't be a robot without a program or in other words code and that's what would give your robot the forth robot characteristic Intelligence, and that is what will be discussed now but we should know what is meant by an Algorithm. The word "algorithm" may not seem relevant to you, but the truth is that algorithms are all around us, governing everything from the technology they use to the worldly decisions they make every day. Algorithms are fascinating and, although some are quite complex, the concept itself is actually quite simple. An algorithm is a detailed step-by-step instruction set or formula for solving a problem or completing a task.

Algorithms are not just related to Programming or Computer Science they are everywhere. A recipe for making food is an algorithm, the method you use to solve addition or long division problems is an algorithm, the process of folding a shirt. Even your morning routine could be considered an algorithm.



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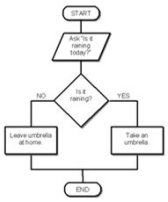
PRESENTING ALGORITHMS:

FLOWCHART



PSEUDOCODE

```
1. PRINT "Please enter the length of the side in cm "
2. INPUT Side
3. Area = Side * Side
4. PRINT Area " cm²"
```

```
1. PRINT "Please enter the length of the side in cm "
2. INPUT Side
3. Area = Side * Side
4. PRINT Area " cm²"
```

ROBO-ARCADE WeDo 2.0

LESSON TWO:

- **WeDo 2.0 Building Pieces** [Book Page/s: 12-13]
- **Programming** [Book Page/s: 19]
- **WeDo 2.0 Programming** [Book Page/s: 31]
- **SCRATCH Studio UI** [Book Page/s: 32-33]
- **Programming Blocks** [Book Page/s: 34-35]
- **Programming Exercise 1**

BUILDING PIECES

When you were Building the walking Robot in the previous session of course you noticed that the LEGO Building Pieces were in different shapes and sizes, In addition to the Main Electronic Parts the WeDo 2.0 core set includes a total of 280 System and Technic pieces, Which are classified to 6 groups, Bricks, Technic Bricks ,Beams, Connecting Pegs, Cross Axles and gears, each of these groups has its functionalities and shapes:

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BRICKS

Bricks are basic Building pieces of all LEGO Models. LEGO bricks are measured and identified by the number of the studs they have on top. The smaller number always comes first, so you say "a 2-by-4 brick," not "a 4-by-2 brick." The width of a 1x1 LEGO brick is the Fundamental LEGO Unit, or module (1 module or 1M is about 8 mm).

TECHNIC BRICKS

Technic bricks are normal Lego Bricks with holes passing through them, in this holes you can insert pegs, cross axels to connect it with other Beams, Technic Bricks or other Building Pieces. Technic bricks are measured by the number of their studs. Except for the 1x1 Technic brick (A), there are no Technic bricks with an odd number of studs.

BEAMS

Beams are basically used to hold cross-axles and other LEGO® components together, so they are the framework of most TECHNIC and MINDSTORMS® models. There are 2 main types of beam: Straight and Angular. Straight beams are usually found only with circular holes in them while angular beams have a mixture of circular and cross-shaped holes, normally with the cross-shaped ones at either end. The straight beams come in sizes from 2 to 15M. These two groups can then be condensed down again into half-beams, beams and bricks.

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CONNECTOR PEGS

There are 3 types of connector pegs:

Round Pegs, Cross-shaped Pegs, Half-half Pegs

The round pegs can be used to connect beams together so that they can both swing freely. The second cross-shaped peg can be used to hold two beams together so that they cannot move, and the last peg can be used to connect a free-spinning beam to a fixed beam. There are also longer versions of the round pegs that can be used to connect multiple beams together. A longer version of the cross-shaped peg is an axle. Some pegs might also be different colours. The black and blue connectors are friction connector pegs, while the other pegs are smooth.

CROSS AXLES

Cross-Axles are cross-shaped rods that can be used to hold wheels, gears beams etc. They are colour coded by their length or you can measure it using a counting the holes of a beam the same size, even-numbered lengths (2M,4M,6M etc) are black while odd-numbered lengths (3M,5M,7M etc) are grey. You can place a cross-axle through a circular hole so it can spin freely. This is a handy connection for building with gears and wheels.

ROBO-ARCADE WeDo 2.0

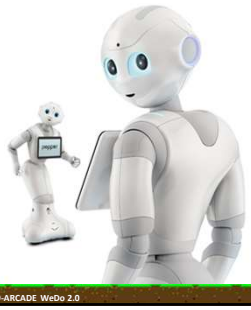
GEARS

A gear is a piece that conveys rotational force to another gear or appliance. The smallest gear in a pair is called the Pinion; the larger gear the gear or the wheel. There are many types of gear that are currently used in LEGO® constructions. The common ones are listed in the following page:

- Spur Gear – A gear that has radial teeth (teeth that spread from the center outwards) parallel to the axis
- Bevel Gear – A gear that can engage another Bevel gear on a different angle (usually 90 degrees)
- Crown Gear - A gear wheel with teeth positioned in the rim at a 90 degree angle to its plane.
- Worm Gear - A short rotating screw that meshes with the teeth of another gear.
- Rack Gear – A toothed block that another gear can mesh (interlock)

1.1 Rack Gear
1.2 Spur Gear
1.3 Bevel Gear
1.4 Worm Gear
1.5 Crown Gear

ROBO-ARCADE WeDo 2.0



PROGRAMMING:

Programming is a process that leads from an original formulation of a computing problem to executable computer programs. Programming involves activities such as analysis, developing understanding, generating algorithms, verification of requirements of algorithms including their correctness and resources consumption, and implementation (commonly referred to as coding) of algorithms in a target programming language. Source code is written in one or more programming languages. The purpose of programming is to find a sequence of instructions that will automate performing a specific task or solving a given problem.

Programming Language: In order for you to communicate with a computer (and to get it to execute your instructions) you must speak its language. In programming, a language is made up of a vocabulary and set of grammatical rules where it gets a little tricky is that each language is based on its own unique syntax (grammatical structure) and semantics (meaning).

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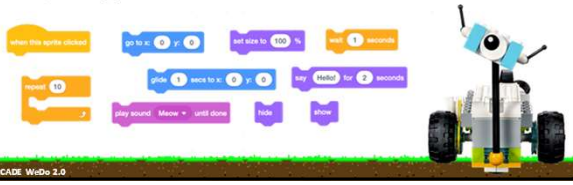
WeDo 2.0 PROGRAMMING:

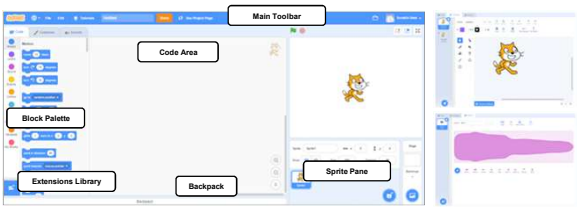
Although LEGO Education has its own programming software for WeDo 2.0, your WeDo 2.0 creations could be programmed using varies third-party applications, including the famous Scratch 3.0. Scratch is a block-based visual programming language, desktop software, android app and website targeted primarily at children 8-16 as an educational tool for STEM Education and Coding. Scratch is developed by the MIT Media Lab, and has been translated into 70+ languages. As of January 2021, community statistics on the official website show more than 67 million projects shared by over 64 million users, and almost 38 million monthly website visits.

We will be using the online version of SCRATCH 3 (SCRATCH Studio) in this course, but you can still use the SCRATCH 3.0 Software, if advised by your teacher. Now lets learn more about SCRATCH User Interface:



SCRATCH STUDIO UI:

Scratch 3.0 has a very simple user interface, which includes awesome features and capabilities. Scratch UI is made up of three main panes: the Code pane, the Sounds pane and the Costumes/Backdrop Pane, the following components covered below are available in the code pane screen:



Scratch UI Components:

Main Toolbar: This is where you can find important project controls, like language, File, Edit, Tutorials, Project name in the image below, Share, Save, Revert, and New, User name, and open project folder are located.

The Block Palette/Code Pane: The area which includes all the Scratch Block, which are divided into 9 groups/ Categories; Motion, Looks, Sound, Events, Control, Sensing, Operators, Data, My Blocks in addition to the extensions. To use any drop just drag it from its group then drop it in the Code Area, You can either click press on any of the Category buttons or use the Scroll Bar, to find a block.

Extensions Library: To open the Extensions Library, press the blue button in the bottom of the Blocks Palette. There you can find 3rd party extensions, which add blocks to your blocks palette giving your projects extra features, the Extensions Library Includes Blocks for LEGO MINDSTORMS EV3, LEGO Education WeDo 2.0, LEGO Boost, Micro:bit and much more.

The Code Area: is the large empty area to the right of the Block Palette, where you drop the selected blocks from the Block Palette to form codes/scripts.

Backpack: This is an area where you save objects that you can use later in other projects. The objects can be costumes, sprites, backdrops, sounds, blocks, and codes. You can drag and drop these objects into the backpack and later drag and drop them from the backpack to reuse in other Scratch projects.

Scratch UI Components:

Sprite Pane: This is the information panel located to the right of the Scripts Area and in the bottom of the stage there you will find a thumbnail for each sprite in your project. When selected, the thumbnail will appear highlighted and its details will show in the Sprite Header located above the list of sprites.

The Sounds Pane: The last tab in the top left area of the interface enables you to create, upload and manipulate sounds.

The Costumes/Backdrop Pane: The costume and backdrop panes can be accessed by clicking the middle tab in between the "code" tab and the "sounds" tab. This is where we can create and manipulate sprites and backdrops. To switch between costume and backdrop panes, select the desired thumbnail in the sprite info pane.

Screenshot from Costumes Pane

Screenshot from the Sounds Pane

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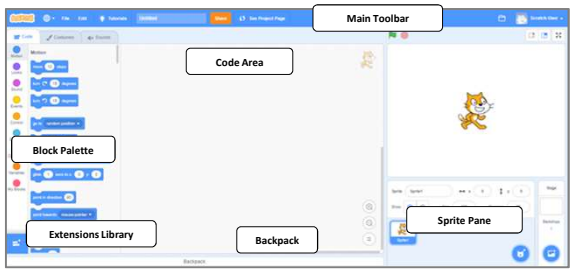
SCRATCH STUDIO UI:



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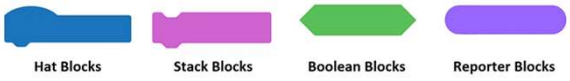
PROGRAMMING BLOCKS:

Blocks are puzzle-piece shapes that are used to create a code in Scratch. The blocks connected to each other vertically similar to a jigsaw puzzle, where each data type (hat, stack, reporter or Boolean) had its own shape and a specially shaped slot for it to be inserted into, which prevented syntax errors. Series of connected blocks were called scripts. There are 4 main types of blocks:



Types of Blocks:

Hat Block: A block that starts a code when a specific event occurs. All hat blocks are either Control blocks, Events blocks, or Blocks from the Extensions.

Stack Block: A block that is shaped to fit above and below other blocks. Stack blocks make up the majority of the blocks available in Scratch, being available in every group except Operators.

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PROGRAMMING BLOCKS:

Blocks are puzzle-piece shapes that are used to create a code in Scratch. The blocks connected to each other vertically similar to a jigsaw puzzle, where each data type (hat, stack, reporter or Boolean) had its own shape and a specially shaped slot for it to be inserted into, which prevented syntax errors. Series of connected blocks were called scripts. There are 4 main types of blocks:

Hat Blocks | Stack Blocks | Boolean Blocks | Reporter Blocks

Types of Blocks:

Reporter Block: A block that reports a value to the device. Values could be anything from strings and numbers to sensors readings.

Boolean Block: A block that reports Boolean values. When the block is used, it acts as a reporter block, reporting "true" or "false" string values or the numbers "1" and "0".

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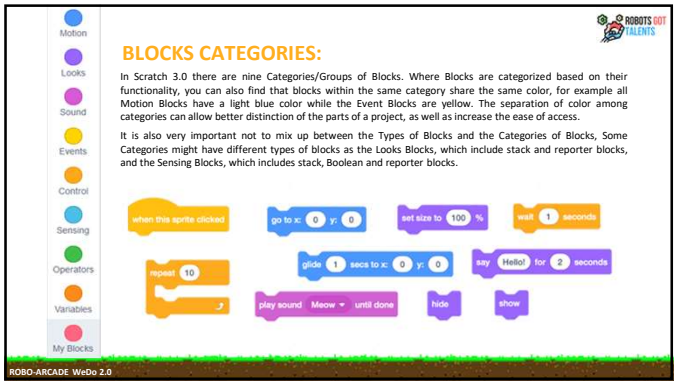
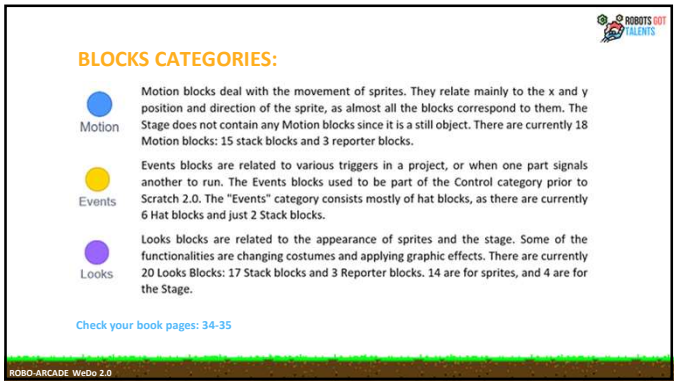
PROGRAMMING EXERCISE 1

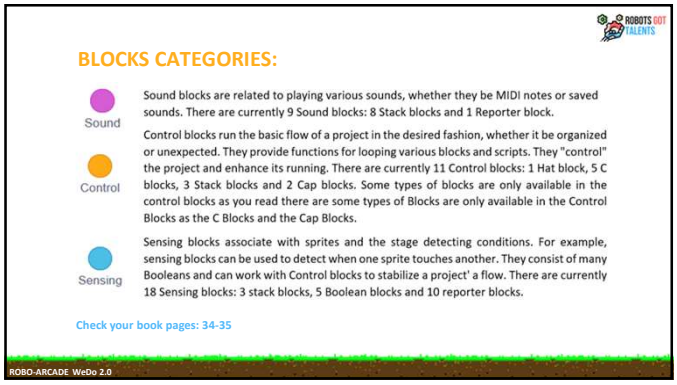
Your first two programming exercises won't be related to WeDo 2.0, but you are going to build really interesting games with SCRATCH 3 which would help you understand the SCRATCH Blocks and user interface more. Guided by an official SCRATCH tutorial you are going to build a basic jumping game, the video tutorial is included in the next page, if you were not able to follow up with the video you can slow up the YouTube video by (Settings > Playback Speed).

Now open SCRATCH Studio, start a new empty project and go to the next page to start the video tutorial

RoboApp-Android users please long press the full screen button, to be able to access the downloadable files if needed.


Motion
Looks
Sound
Events
Control
Sensing
Operators
Variables
My Blocks
BLOCKS CATEGORIES:
In Scratch 3.0 there are nine Categories/Groups of Blocks. Where Blocks are categorized based on their functionality, you can also find that blocks within the same category share the same color, for example all Motion Blocks have a light blue color while the Event Blocks are yellow. The separation of color among categories can allow better distinction of the parts of a project, as well as increase the ease of access.
It is also very important not to mix up between the Types of Blocks and the Categories of Blocks, Some Categories might have different types of blocks as the Looks Blocks, which include stack and reporter blocks, and the Sensing Blocks, which includes stack, Boolean and reporter blocks.
when this sprite clicked
go to x: 0 y: 0
set size to 100 %
wait 1 seconds
repeat 10
glide 1 secs to x: 0 y: 0
say Hello! for 2 seconds
play sound Meow until done
hide
show
ROBO-ARCADE WeDo 2.0


BLOCKS CATEGORIES:
Motion
Motion blocks deal with the movement of sprites. They relate mainly to the x and y position and direction of the sprite, as almost all the blocks correspond to them. The Stage does not contain any Motion blocks since it is a still object. There are currently 18 Motion blocks: 15 stack blocks and 3 reporter blocks.
Events
Events blocks are related to various triggers in a project, or when one part signals another to run. The Events blocks used to be part of the Control category prior to Scratch 2.0. The "Events" category consists mostly of hat blocks, as there are currently 6 Hat blocks and just 2 Stack blocks.
Looks
Looks blocks are related to the appearance of sprites and the stage. Some of the functionalities are changing costumes and applying graphic effects. There are currently 20 Looks Blocks: 17 Stack blocks and 3 Reporter blocks. 14 are for sprites, and 4 are for the Stage.
Check your book pages: 34-35
ROBO-ARCADE WeDo 2.0


BLOCKS CATEGORIES:
Sound
Sound blocks are related to playing various sounds, whether they be MIDI notes or saved sounds. There are currently 9 Sound blocks: 8 Stack blocks and 1 Reporter block.
Control
Control blocks run the basic flow of a project in the desired fashion, whether it be organized or unexpected. They provide functions for looping various blocks and scripts. They "control" the project and enhance its running. There are currently 11 Control blocks: 1 Hat block, 5 C blocks, 3 Stack blocks and 2 Cap blocks. Some types of blocks are only available in the control blocks as you read there are some types of Blocks are only available in the Control Blocks as the C Blocks and the Cap Blocks.
Sensing
Sensing blocks associate with sprites and the stage detecting conditions. For example, sensing blocks can be used to detect when one sprite touches another. They consist of many Booleans and can work with Control blocks to stabilize a project' a flow. There are currently 18 Sensing blocks: 3 stack blocks, 5 Boolean blocks and 10 reporter blocks.
Check your book pages: 34-35
ROBO-ARCADE WeDo 2.0

BLOCKS CATEGORIES:

Operators

Operator's blocks deal with many mathematical functions within a project and provide the capabilities of simple to complex mathematical operations. "Operators" also contains blocks for modifying strings and implementing them into various uses. There are some Boolean blocks, too, in which some are related to mathematical outputs, while others are used for adjoining other Booleans into one or a different output condition. There are currently 18 Operators blocks: 7 Boolean blocks and 11 Reporter blocks.

Variables

Data blocks include two subcategories, Variables and Lists, but both are related to storing and accessing data. Prior to Scratch 2.0, this category was called "Variables". Data blocks are used for storing information, such as a score in a project, and using it in scripting and other beneficial purposes. There are currently 17 Variables blocks: 11 Stack blocks, 5 Reporter blocks, and 1 Boolean block. There are 5 variable blocks and 12 list blocks.

Check your book pages: 34-35

ROBO-ARCADE WeDo 2.0

BLOCKS CATEGORIES:

My Blocks

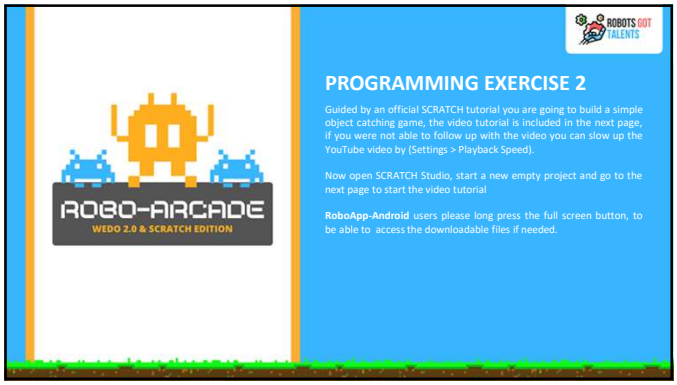
My blocks are blocks that hold custom procedures for a selected sprite. The blocks are useful for running a script without screen refresh and organization of the scripts. Clicking Make a Block brings up a dialogue allowing the user to make a procedure. Once OK is pressed, the new block appears in the palette and an empty definition appears in the code area. When the procedure runs, Scratch will run the blocks below the corresponding Define block.

Check your book pages: 34-35

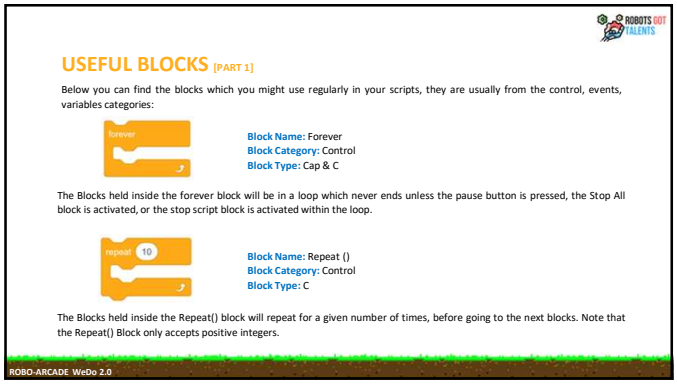
ROBO-ARCADE WeDo 2.0

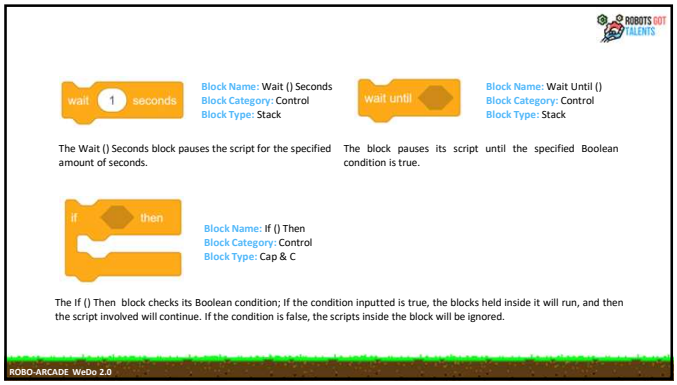
LESSON THREE:

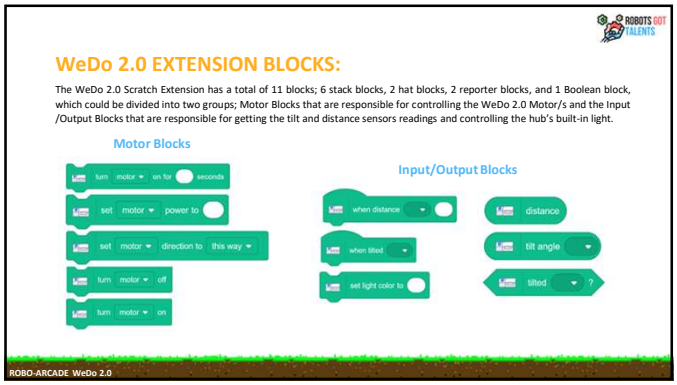
- **Programming Exercise Two**
- **Useful Blocks P1** [Book Page/s: 40-42]
- **WeDo 2.0 Extension** [Book Page/s: 31-36]
- **Motor Blocks** [Book Page/s: 37]
- **Useful Blocks P2** [Book Page/s: 40-42]
- **Programming Exercise Three**

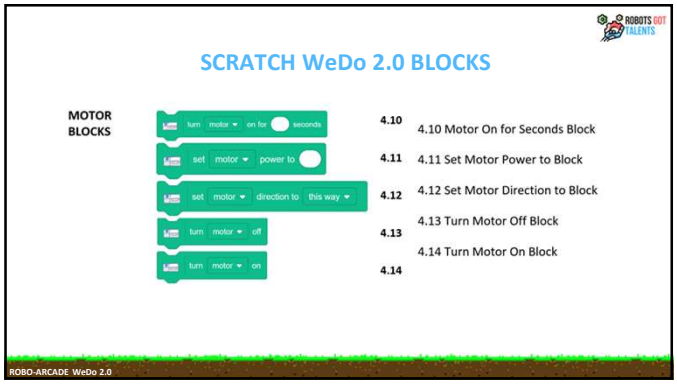

ROBO-ARCADE
WEDO 2.0 & SCRATCH EDITION
PROGRAMMING EXERCISE 2
Guided by an official SCRATCH tutorial you are going to build a simple object catching game, the video tutorial is included in the next page, if you were not able to follow up with the video you can slow up the YouTube video by (Settings > Playback Speed).
Now open SCRATCH Studio, start a new empty project and go to the next page to start the video tutorial
RoboApp-Android users please long press the full screen button, to be able to access the downloadable files if needed.


How to make a
Catch Game
in
SCRATCH


USEFUL BLOCKS [PART 1]
Below you can find the blocks which you might use regularly in your scripts, they are usually from the control, events, variables categories:
forever
Block Name: Forever
Block Category: Control
Block Type: Cap & C
The Blocks held inside the forever block will be in a loop which never ends unless the pause button is pressed, the Stop All block is activated, or the stop script block is activated within the loop.
repeat 10
Block Name: Repeat ()
Block Category: Control
Block Type: C
The Blocks held inside the Repeat() block will repeat for a given number of times, before going to the next blocks. Note that the Repeat() Block only accepts positive integers.
ROBO-ARCADE WeDo 2.0

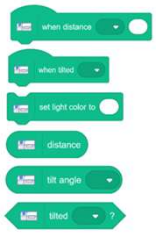

wait 1 seconds
Block Name: Wait () Seconds
Block Category: Control
Block Type: Stack
wait until
Block Name: Wait Until ()
Block Category: Control
Block Type: Stack
The Wait () Seconds block pauses the script for the specified amount of seconds.
The block pauses its script until the specified Boolean condition is true.
if then
Block Name: If () Then
Block Category: Control
Block Type: Cap & C
The If () Then block checks its Boolean condition; If the condition inputted is true, the blocks held inside it will run, and then the script involved will continue. If the condition is false, the scripts inside the block will be ignored.
ROBO-ARCADE WeDo 2.0


WeDo 2.0 EXTENSION BLOCKS:
The WeDo 2.0 Scratch Extension has a total of 11 blocks; 6 stack blocks, 2 hat blocks, 2 reporter blocks, and 1 Boolean block, which could be divided into two groups; Motor Blocks that are responsible for controlling the WeDo 2.0 Motor/s and the Input /Output Blocks that are responsible for getting the tilt and distance sensors readings and controlling the hub's built-in light.
Motor Blocks
Input/Output Blocks
ROBO-ARCADE WeDo 2.0


SCRATCH WeDo 2.0 BLOCKS
MOTOR BLOCKS
4.10
4.10 Motor On for Seconds Block
4.11
4.11 Set Motor Power to Block
4.12
4.12 Set Motor Direction to Block
4.13
4.13 Turn Motor Off Block
4.14
4.14 Turn Motor On Block
ROBO-ARCADE WeDo 2.0

SCRATCH WeDo 2.0 BLOCKS

INPUT & OUTPUT BLOCKS



4.15 4.15 When Distance Block

4.16 4.16 When Tilted Block

4.17 4.17 Set Light Colour to Block

4.18 4.18 Distance Block

4.19 4.19 Tilt Angle Block

4.20 4.20 Tilted Boolean Block

ROBO-ARCADE WeDo 2.0

WeDo 2.0 SCRATCH SETTINGS:

Adding the WeDo 2.0 Extension:

- Open the Scratch extensions menu/library below the Blocks Palette
- Choose the LEGO Education WeDo 2.0 extension

Connecting the WeDo 2.0 Hub:

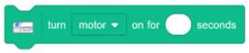
- Enable Bluetooth
- Download and Install the WeDo /Scratch link
- Choose your WeDo 2.0 hub then press connect

Download Scratch Link: https://scratch.mit.edu/wedo

ROBO-ARCADE WeDo 2.0

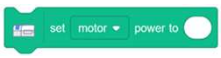
MOTOR BLOCKS:

The Motor Blocks are the commands responsible for controlling the WeDo 2.0 Motor/s. There are currently 5 stack motor blocks. Scratch WeDo Motor Blocks manages the power, direction, and the duration of working:



Block Name: Motor On for Seconds
Block Type: Stack

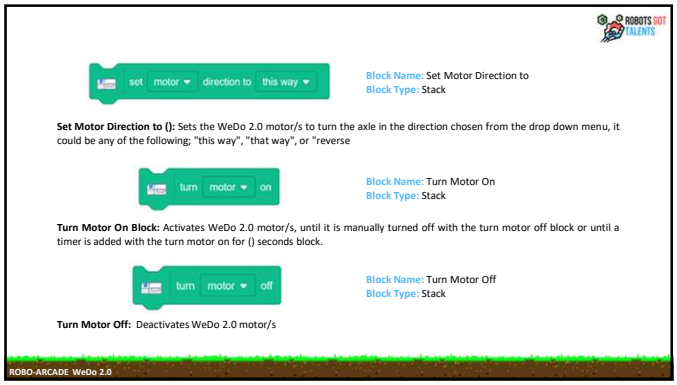
The Turn Motor On for () Seconds Block: Starts one or two WeDo 2.0 motors for a chosen amount of time specified in seconds. The amount of time can be set with a numeric input, using whole or decimal numbers.



Block Name: Set Motor Power to
Block Type: Stack

Set Motor Power to (): Sets the WeDo 2.0 motor/s power to the specified level which can be set with a numeric input from 0 to 100 Only whole numbers accepted.

ROBO-ARCADE WeDo 2.0

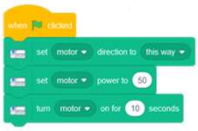

set motor direction to this way
Block Name: Set Motor Direction to
Block Type: Stack
Set Motor Direction to (): Sets the WeDo 2.0 motor/s to turn the axle in the direction chosen from the drop down menu, it could be any of the following; "this way", "that way", or "reverse
turn motor on
Block Name: Turn Motor On
Block Type: Stack
Turn Motor On Block: Activates WeDo 2.0 motor/s, until it is manually turned off with the turn motor off block or until a timer is added with the turn motor on for () seconds block.
turn motor off
Block Name: Turn Motor Off
Block Type: Stack
Turn Motor Off: Deactivates WeDo 2.0 motor/s
ROBO-ARCADE WeDo 2.0


USEFUL BLOCKS [PART 2]
Below you can find the blocks which you might use regularly in your scripts, they are usually from the control, events, variables categories:
when clicked
Block Name: When Green Flag Clicked
Block Category: Events
Block Type: Hat
Scripts placed below the When Green Flag Clicked, also known as the Start Block will activate when the Green Flag (Play Button) is pressed.
when key pressed
Block Name: When () Key Pressed
Block Category: Events
Block Type: Hat
Scripts placed below the When () Key Pressed will activate when a specified pre-chosen key is pressed. The keys that can be sensed with this block include all the English alphabet (a, b, c ...), the number keys (0, 1, 2 ...), the arrow keys (← ↑ → ↓), and the space key. The block also include the "Any" option which activities the code when any key is pressed
ROBO-ARCADE WeDo 2.0

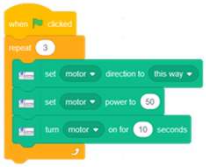

ROBO-ARCADE
WEDO 2.0 & SCRATCH EDITION
PROGRAMMING EXERCISE 3
Now you are ready to start programming WeDo 2.0 robots using SCRATCH 3, Using the Blocks explained previously in the course, program the WeDo 2.0 WalkingBot, which you built in the first lesson to do the following tasks:
TASK 1: Program your robot to move forward for 10 seconds with a power of 8 when the green flag is pressed.
TASK 2: Repeat Task 1 three times without using more than 6 blocks.
TASK 3: Program your robot to move forward when the up arrow is pressed, move backward when the down arrow is pressed, and stop when the Space button is pressed.
RoboApp-Android users please long press the full screen button, to be able to access the downloadable files if needed.

EXERCISE THREE SOLUTION:

Task 1



Task 2



Task 3

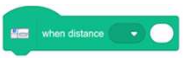
ROBO-ARCADE WeDo 2.0

LESSON FOUR:

- **Input/Output Blocks** [Book Page/s: 38]
- **Building Exercise 2**
- **Useful Blocks P3** [Book Page/s: 40-42]
- **SCRATCH Costume Pane** [Book Page/s: 33]
- **Project 1 (Boxing Game)**

INPUT/OUTPUT BLOCKS:

The Input and Output Blocks are the commands responsible for detecting the WeDo 2.0 Sensor Inputs and managing the WeDo 2.0 Outputs. There are currently 6 blocks: 2 hat blocks, 2 reporter blocks, 1 stack block and 1 Boolean block.



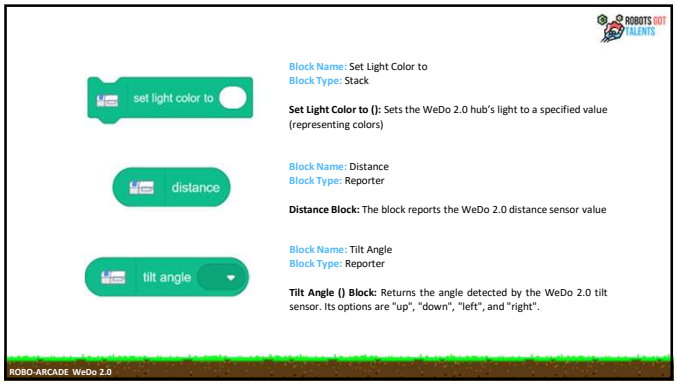
Block Name: When Distance
Block Type: Hat

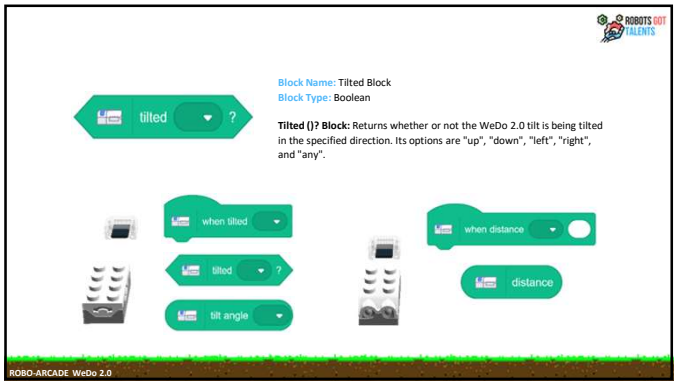
The When Distance () () Block: Activates the code added below when the distance is less than or greater than the specified value, depending on the argument selected from the drop-down menu. options for the when distance block are "> greater than" "< smaller than"

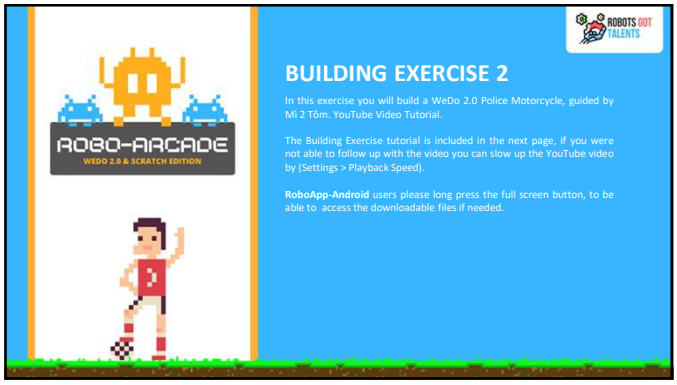
Block Name: When Tilted
Block Type: Hat

The When Tilted () Block: Activates the code added below when the tilt sensor reads a change in a direction according to the option selected from the drop-down menu, options for the when tilted block are "up", "down", "left", "right", and "any"

ROBO-ARCADE WeDo 2.0


set light color to
distance
tilt angle
Block Name: Set Light Color to
Block Type: Stack
Set Light Color to (): Sets the WeDo 2.0 hub's light to a specified value (representing colors)
Block Name: Distance
Block Type: Reporter
Distance Block: The block reports the WeDo 2.0 distance sensor value
Block Name: Tilt Angle
Block Type: Reporter
Tilt Angle () Block: Returns the angle detected by the WeDo 2.0 tilt sensor. Its options are "up", "down", "left", and "right".
ROBO-ARCADE WeDo 2.0


tilted ?
Block Name: Tilted Block
Block Type: Boolean
Tilted ()? Block: Returns whether or not the WeDo 2.0 tilt is being tilted in the specified direction. Its options are "up", "down", "left", "right", and "any".
when tilted
tilted ?
tilt angle
when distance
distance
ROBO-ARCADE WeDo 2.0


ROBO-ARCADE
WEDO 2.0 & SCRATCH EDITION
BUILDING EXERCISE 2
In this exercise you will build a WeDo 2.0 Police Motorcycle, guided by Mi 2 Tõm. YouTube Video Tutorial.
The Building Exercise tutorial is included in the next page, if you were not able to follow up with the video you can slow up the YouTube video by (Settings > Playback Speed).
RoboApp-Android users please long press the full screen button, to be able to access the downloadable files if needed.

USEFUL BLOCKS [PART 3]

Below you can find the blocks which you might use regularly in your scripts, they are usually from the control, events, variables categories:

Block Name: Repeat Until ()
Block Category: Control
Block Type: C

Blocks held inside the Repeat Until () block will loop until the specified Boolean statement is true, or a certain event occur.

Block Name: Set () to ()
Block Category: Variables
Block Type: Stack

The Set () variable to () variable block will set the specified variable to the given value (string or number)

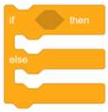
ROBO-ARCADE WeDo 2.0

Block Name: Change () by ()
Block Category: Variables
Block Type: Stack

The block will change the specified variable by a given amount. If the variable is a string and not a number, it is set to the quantity the variable was to be changed by (casting the string to 0).

Block Name: Variable ()
Block Category: Variables
Block Type: Reporter

Whenever a variable is created, a version of the block appears with the variable's given name on it — this results in a version of this block for every variable. Each version of the block holds its 'assigned' variable.



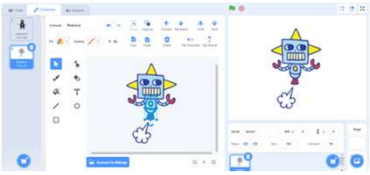
Block Name: If () then, else
Block Category: Control
Block Type: Cap & C

The If () then, else block checks its Boolean condition; if the condition inputted is true, the code held inside the first C (space) will activate; if the condition is false, the code inside the second C will activate.

ROBO-ARCADE WeDo 2.0

COSTUME PANE

The Costume Pane which includes the Paint Editor is an easy to use built-in Image Editor available in SCRATCH Studio, where you can edit or even create your own sprites and backdrops. This is one of the main features which makes Scratch different from many other programming tools. Although you have used the Customs Pane in the previous SCRATCH Exercises, you need to understand all its tools, as we will be contentiously using it in the ROBO-ARCADE (SCRATCH 3 & WeDo 2.0) Exercises :



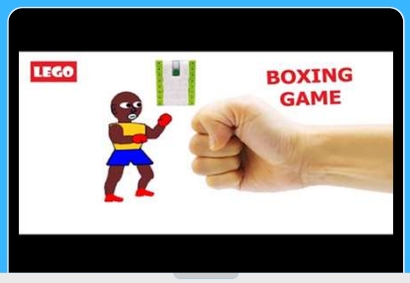
Editing Sprites

The costumes are placed vertically in right side of the costume pane. The layout consists of the thumbnails of each costume along with a few properties. Underneath the costume thumbnail is the costume name and resolution. In the top-left of the thumbnail is a small digit representing the costume's value. By selecting any costume, it will appear on the Paint Editor, so you can edit anything if needed.

ROBO-ARCADE WeDo 2.0

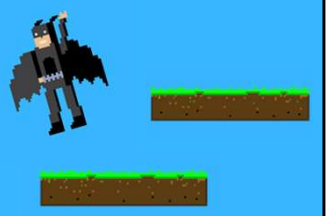
PROJECT ONE [Boxing Game]

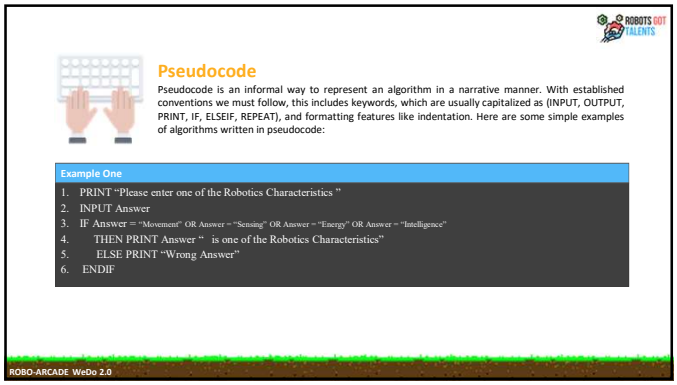
Mì 2 Tôm

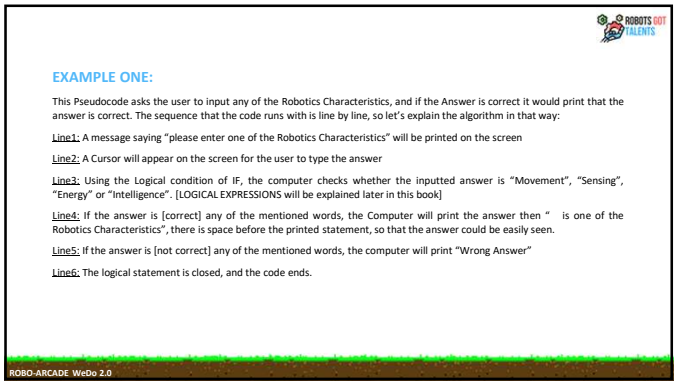


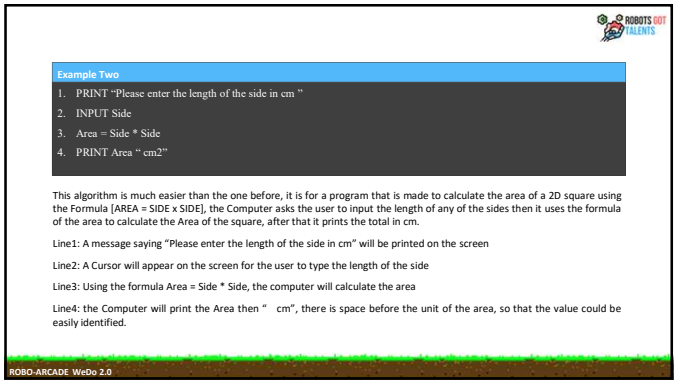
LESSON FIVE:

- **Pseudocode** [Book Page/s: 15-18]
- **Useful Blocks P4**
- **Project 2 (Space Mission Game)**
- **Project 3 (Snow Race Game)**




Pseudocode
Pseudocode is an informal way to represent an algorithm in a narrative manner. With established conventions we must follow, this includes keywords, which are usually capitalized as (INPUT, OUTPUT, PRINT, IF, ELSEIF, REPEAT), and formatting features like indentation. Here are some simple examples of algorithms written in pseudocode:
Example One
1. PRINT "Please enter one of the Robotics Characteristics "
2. INPUT Answer
3. IF Answer = "Movement" OR Answer = "Sensing" OR Answer = "Energy" OR Answer = "Intelligence"
4. THEN PRINT Answer " is one of the Robotics Characteristics"
5. ELSE PRINT "Wrong Answer"
6. ENDIF
ROBO-ARCADE WeDo 2.0


EXAMPLE ONE:
This Pseudocode asks the user to input any of the Robotics Characteristics, and if the Answer is correct it would print that the answer is correct. The sequence that the code runs with is line by line, so let's explain the algorithm in that way:
Line1: A message saying "please enter one of the Robotics Characteristics" will be printed on the screen
Line2: A Cursor will appear on the screen for the user to type the answer
Line3: Using the Logical condition of IF, the computer checks whether the inputted answer is "Movement", "Sensing", "Energy" or "Intelligence". [LOGICAL EXPRESSIONS will be explained later in this book]
Line4: If the answer is [correct] any of the mentioned words, the Computer will print the answer then " is one of the Robotics Characteristics", there is space before the printed statement, so that the answer could be easily seen.
Line5: If the answer is [not correct] any of the mentioned words, the computer will print "Wrong Answer"
Line6: The logical statement is closed, and the code ends.
ROBO-ARCADE WeDo 2.0


Example Two
1. PRINT "Please enter the length of the side in cm "
2. INPUT Side
3. Area = Side * Side
4. PRINT Area " cm2"
This algorithm is much easier than the one before, it is for a program that is made to calculate the area of a 2D square using the Formula [AREA = SIDE x SIDE], the Computer asks the user to input the length of any of the sides then it uses the formula of the area to calculate the Area of the square, after that it prints the total in cm.
Line1: A message saying "Please enter the length of the side in cm" will be printed on the screen
Line2: A Cursor will appear on the screen for the user to type the length of the side
Line3: Using the formula Area = Side * Side, the computer will calculate the area
Line4: the Computer will print the Area then " cm", there is space before the unit of the area, so that the value could be easily identified.
ROBO-ARCADE WeDo 2.0

PSEUDOCODE FORMATTING & KEYWORDS

INPUT	Used to Input/add a value or a statement to the code.
INPUT "Please Enter your name" Name	
PRINT, OUTPUT	Used to Print/output a value or a statement.
PRINT "Your name is " Name	
IF……ELSE……ENDIF	A type of logical expressions that asks for a certain condition to complete the code.
IF Password = "12345" THEN PRINT "Correct Password" ELSE PRINT "Wrong Password" ENDIF	

ROBO-ARCADE WeDo 2.0

PSEUDOCODE FORMATTING & KEYWORDS

REPEAT……UNTIL	A type of Loops (Repeat functions) that repeats a part of the code until a certain condition is found.
REPEAT INPUT Password UNTIL Password = "12345"	
FOR…..TO…..NEXT	A type of Loops (Repeat functions) that repeats a part of a known number of times before going to the next part of the code
FOR Count 1 TO 5 INPUT Password NEXT Count	

ROBO-ARCADE WeDo 2.0

USEFUL BLOCKS [PART 4]

Below you can find the blocks which you might use regularly in your scripts, they are usually from the control, events, variables categories:

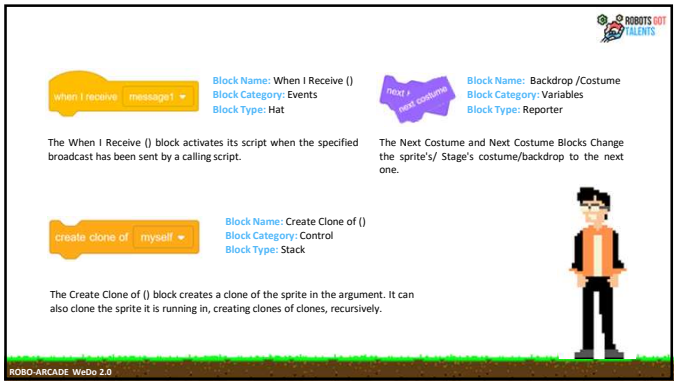
Block Name: Broadcast
Block Category: Event
Block Type: Stack

The Broadcast () Block sends a message throughout the Scratch program, any scripts which start with the When I Receive () block will activate.

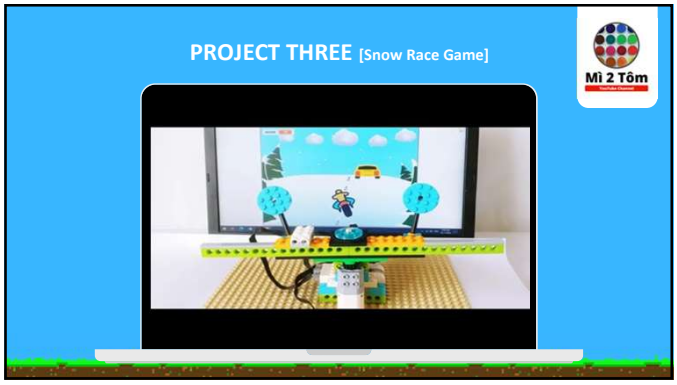
Block Name: Broadcast and Wait
Block Category: Event
Block Type: Stack

The Broadcast () and Wait Block sends a message throughout the Scratch program, any scripts which start with the When I Receive () block will activate, and then the Script with the Broadcast() and Wait Block will resume.

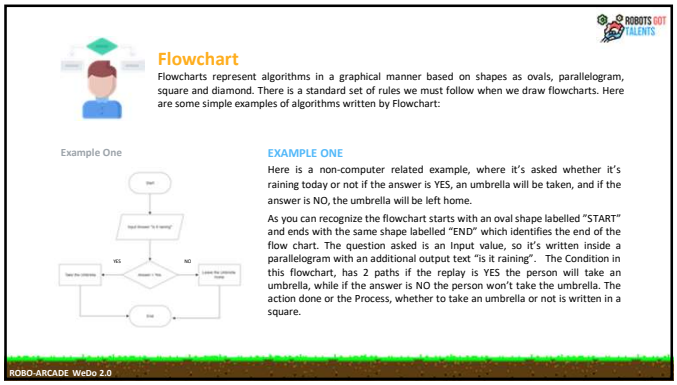
ROBO-ARCADE WeDo 2.0


when I receive message1
Block Name: When I Receive ()
Block Category: Events
Block Type: Hat
The When I Receive () block activates its script when the specified broadcast has been sent by a calling script.
next ▸ next costume
Block Name: Backdrop /Costume
Block Category: Variables
Block Type: Reporter
The Next Costume and Next Costume Blocks Change the sprite's/ Stage's costume/backdrop to the next one.
create clone of myself
Block Name: Create Clone of ()
Block Category: Control
Block Type: Stack
The Create Clone of () block creates a clone of the sprite in the argument. It can also clone the sprite it is running in, creating clones of clones, recursively.
ROBO-ARCADE WeDo 2.0


PROJECT THREE [Space Mission Game]
Mì 2 Tôm


PROJECT THREE [Snow Race Game]
Mì 2 Tôm


LESSON SIX:
Flowchart [Book Page/s: 17-18]
Project 4 (Alien Hunter Game)
Project 5 (Cars Game)


Flowchart
Flowcharts represent algorithms in a graphical manner based on shapes as ovals, parallelogram, square and diamond. There is a standard set of rules we must follow when we draw flowcharts. Here are some simple examples of algorithms written by Flowchart:
Example One
EXAMPLE ONE
Here is a non-computer related example, where it's asked whether it's raining today or not if the answer is YES, an umbrella will be taken, and if the answer is NO, the umbrella will be left home.
As you can recognize the flowchart starts with an oval shape labelled "START" and ends with the same shape labelled "END" which identifies the end of the flow chart. The question asked is an Input value, so it's written inside a parallelogram with an additional output text "is it raining". The Condition in this flowchart, has 2 paths if the replay is YES the person will take an umbrella, while if the answer is NO the person won't take the umbrella. The action done or the Process, whether to take an umbrella or not is written in a square.
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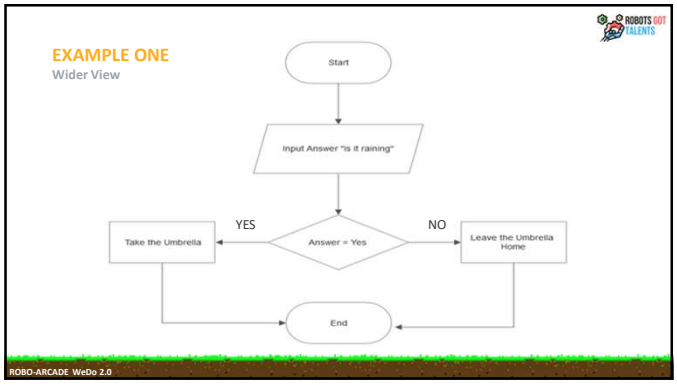
EXAMPLE ONE
Wider View
Start
Input Answer "is it raining"
YES
NO
Take the Umbrella
Answer = Yes
Leave the Umbrella Home
End
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Example Two

EXAMPLE TWO

The same example used in the Pseudocode section, This Flowchart, uses the side of a square to calculate its area in cm square.

The Chart starts with the Start shape then we have an input value where the user could enter the length of the side, the text added to the input parallelogram is known as hint or comment, which guides the user about the value he should input. The Length of the Side must be greater than 0 so if the Value is not greater than 0, then the input is not correct and that's what is mentioned in the condition, if the Side > 0, the sequence would go to the right side, and Calculate the Area using the Area of the Square Formula then print it, while if the answer is not > 0, the Device would print "wrong entry".

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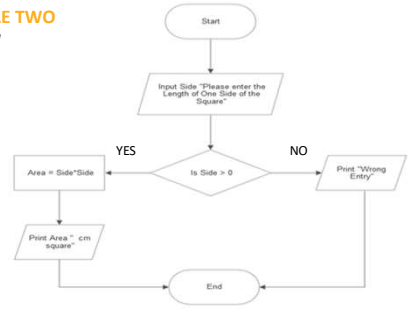
EXAMPLE TWO

Wider View



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Symbol	Name	Description
Start	Beginning of the algorithm	It denotes the start of the algorithm. Everything in the algorithm comes ultimately from this symbol.
input/output	Input statement/ Output statement	Input statements either read from another file or receive input from the user. Output statements output information onto the screen.
assignment	Assignment/ Process statement	Assignment statements assign a value to a variable.
call	Procedure call	This symbol 'calls' a pre-defined procedure or function.

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PROJECT FOUR [Alien Hunter Game]
Mì 2 Tôm
LEGO
WEDO
SCRATCH
Alien
Hunter


PROJECT FIVE [Cars Game]
Mì 2 Tôm
Steering Wheel
Racing


ROBO-ARCADE
WEDO 2.0 & SCRATCH EDITION
ROBOTS GOT TALENTS
THANK YOU
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