Variables

Ages: 7-11
Length: 1 hour
Equipment: PDF print out

Introduction

This lesson introduces the relevant words; **_variables_** through activities that link to student's lives to help them relate to the concepts introduced. This lesson will build upon prior learning relating to selection.

Curriculum Alignment	❤ UK National Curriculum Computing Key Stage 2
Learning Objective	❤ To describe what a variable is ❤ To demonstrate the use of variables
Keywords	❤ Variable ❤ Store
Resources	❤ Paper and pens
Lesson Sections	❤ Setting the Scene ❤ Activity 1 – Identifying and applying variables ❤ Activity 2 – MiRo simulator ❤ Summary

Setting the Scene

How do we remember key facts to use again?

We remember key information, and this can be stored to use in future cases.

Concept	How it is used
A **_variable_** is a storage location within the code, where the value can be changed and stored to be called upon. *Can you think of when you have remembered something that you have used in other situations?*	When you write code, it is not always straight forward as aspects of the code may change. A variable is like a box, you put a value inside and when it is needed the box is opened and the value used.

You can create as many **_variables_** as you need within the code you are writing, but the name of the **_variable_** is important to make sure you know which is which.

First let us look at what a **_variable_** looks like.

Activity 1

Activity 1 is focused on getting students to think about what a **_variable_** is and relate this to their everyday tasks.

Scenario 1	Scenario 2
You have received some money for your birthday, and you are going shopping. - How do you know how much you have? - How do you know how much you have left after the first purchase? - How to you know when you have spent it all?	You have decided to buy the latest game console but need to do some price searching? - Where can you buy it from? - When you look at one shop how much is it? - How do you know which the cheapest option is?

Where else do you remember a **_value_** to use again?

Whole Class Activity

Explain to the group that you are going to play 'I went to the shops and bought', each person must remember the items bought before and add to it for the next person to remember them all and add to it.

This activity shows the use of a variable and how the value held can be changed and called upon whenever it is needed.

Small Group Activity

Split the students into small groups and give them a blank piece of paper.

In your group, I want you to play rock, paper, scissors

When they have played a few rounds ask, "who is winning?" – remind them they have a piece of paper.

Encourage discussion within the group, ask them to think how they would know who was winning without the paper? They would need to remember the score each time and after each game add to the score and remember the new score.

You use **_variables_** without thinking on a daily basis. You may find a time where you must remember (**_store_**) a value and recall it when asked – how about maths equations or science experiments?

Activity 2

What are the blocks available for ***variables***?

They are located within the 'variables' icon.

The default for the name of the variable is 'item' and this can be changed by clicking the dropdown list and selecting 'rename variable'.

Why should you use a suitable name for a variable?

Because they will help you keep track of your objective as you continue to write your program.

What is a sensor and how can we use it to stop MiRo falling off the table edge?

A sensor takes input from the environment around it. So we can use the sonar sensors to get information on if the path in front of MiRo is clear of obstacles.

The sensor on MiRo is constantly reading what is around it and storing this information. We need to set a place to store this information so we can use it; we are going to create a variable.

Can you write some instructions out for the algorithm to avoid the edge?

Algorithm for edge avoiding:
      Start moving forwards fast
      Look at the ground
      If the sensor detects the edge
            Stop moving
            Start turning fast

> **What would the name of your variable be?**

Collision, edge, warning etc,

> **Why is the name of the variable just as important as the content?**

Because the name of the variable is what helps you order and track your program as you go along.

Students are now guided step by step on how to create the algorithm above, this may change due to what they have written.

Students are guided to create + run an algorithm to get MiRo to move and not collide with any objects.

For advanced students, the **Step-by-Step** guide can be left off and they can work their way through the steps on their own.

Activity 2 - Program solution - Part 1 Sonar Range Sensor

NB. There can be more than one solution in programming, encourage experimentation and use solution below as a guide

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Step 1-8 ❤ Add 'program start' from 'Setup' ❤ Add 1 x Periodic Control Loop block ❤ Add 1 x Start Moving Forwards block ❤ Change the speed from 'slow' to 'fastest' ❤ Add 1 x set item block ❤ Add 1 x Sonar Range block ❤ Add 1 x Run code block ❤ Change the text from '#Enter your own python code' to 'print(item)'	** The aim of this program is to show pupils what the sensor is detecting. The value is output through each movement and shown in the console area at the bottom of the screen. ** When the sensor detects an object the pupil will see the value jump to 1.0 and is a discussion opportunity for how this value could be used to control MiRo's movement. This then forms the next activity. ** The RUN CODE is showing an introduction to textual code 'python' where the output is set through the use of the 'print' command.
Step 9 ❤ Click Simulate Play	** This activity is to run only on the simulator for the output to be visible on the console area.
Follow a Program Script at bottom of screen shows code running and the initial values of the sonar range is output each time MiRo moves.	When the Sonar Range detects an object, observe how the sensor is now outputting a '1.0'

Activity 2 - Program solution - Part 2 MiRo Move Around Area

NB. There can be more than one solution in programming, encourage experimentation and use solution below as a guide

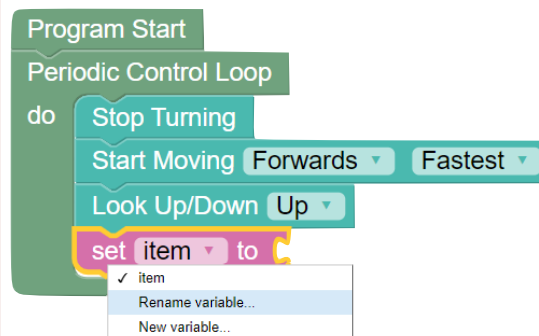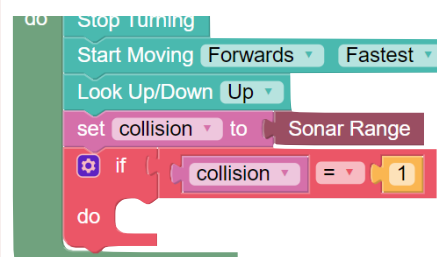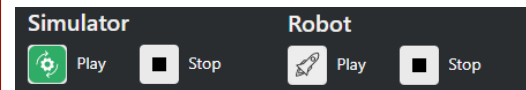|	
Step 1-6 ❥ Add 'program start' from 'Setup' ❥ Add 1 x Periodic Control Loop block ❥ Add 1 x Stop Turning block ❥ Add 1 x Start Moving Forwards block ❥ Change the speed from 'slow' to 'fastest' ❥ Add 1 x Look Up/Down block	** This initial part of the program will set MiRO moving forwards, looking up and at the fastest speed. Program Start Periodic Control Loop do Stop Turning Start Moving Forwards Fastest Look Up/Down Up
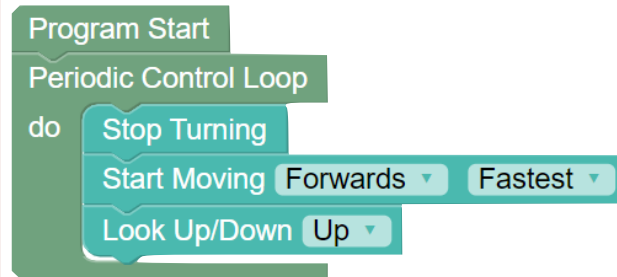
Step 7-9
❥ Add 1 x set item block
❥ Rename the variable to 'collision' by:
   ○ Click the arrow next to the word 'item'
   ○ Select 'rename variable'
   ○ Rename variable to: 'collision'
❥ Add 1 x Sonar Range block
	** The variable has a default name and to change it to a suitable name for the program, the arrow next to the word 'item' needs to be selected to access the drop-down menu.
	
	Program Start
	Periodic Control Loop
	do Stop Turning
	Start Moving Forwards Fastest
	Look Up/Down Up
	set item to
	  ✓ item
	  Rename variable...
	  New variable...
	
	**By setting the variable to the sensor 'Sonar Range' the variable will store the value detected by MiRo, relating to the distance to any object.

Step 10-14 ❥ Add 1 x if do block ❥ Add 1 x collision block ❥ Add 1 x '0' block ❥ Change the '0' to '1'	**The use of the logic blocks will form a conditional statement to test the value stored in the variable. This is 'selection' and will be looked at in more detail in the next lesson. do Stop Turning Start Moving Forwards Fastest Look Up/Down Up set collision to Sonar Range ⚙ if collision = 1 do **if** the value stored in the variable is equal to '1': Then the code within the do section will be activated.

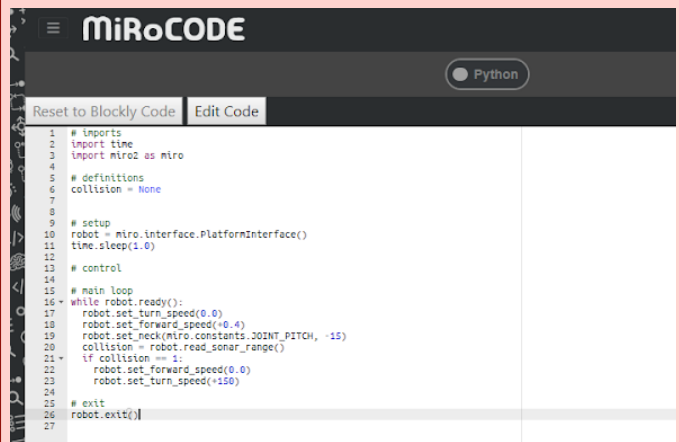|	
Step 15-17 ❤ Add 1 x Stop Moving block ❤ Add 1 x Start Turning block ❤ Change 'slow' to 'fastest'	** Now when MiRo detects an object in the way, through the sonar range. It will stop moving and start turning away from the object.
Step 18 ❤ Click Simulator Play OR ❤ Click Robot Play	** If you are using the physical MiRO ensure the IP address is correctly added to the onscreen code to allow the code to be communicated to MiRO to action. ** If you are using the simulator it is recommended to zoom in to see MiRo clearly but not essential.
Follow a Program Script at bottom of screen shows code is ready and waiting for the 'clap'	The clap button or a physical clap will need to be heard by MiRo at the appropriate time for the program to proceed. The script at the bottom will show the program has ended.
Extension Click the button above the block code with the word 'Blockly' on it and switch the screen to 'python'. Can you narrate anything that happens in the code? For higher ability pupils ask them to adjust the settings within the line of code with the same set of numbers as the block.	

Summary

Have a discussion with the class about what they have learnt in the lesson. Discuss the new word learnt: variable and store and talk through any difficulties they had.

Ask students to complete the self-assessment and can be done by thumbs up, down and centre or using the images; on the following 3 questions.

Questions
Can you identify a variable?
Can you describe what a variable is?
Can you create and use a variable in the MiRo simulator?