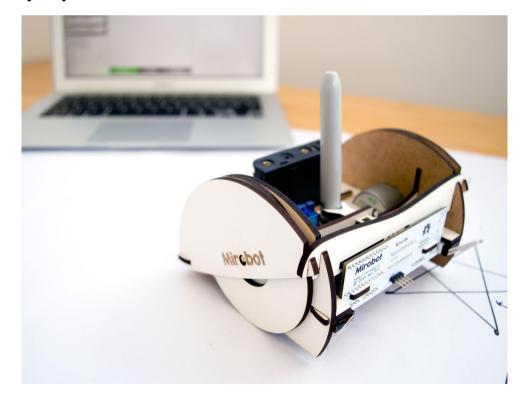# Switch on STEM

TECHNOLOGY

Robot Code

Introduction

In the 1980's there was a computer game called Logo where the objective was to make a turtle draw shapes on screen.

In recent years a robot has been developed to use the same basic instructions to draw on paper.

The interface is easy to learn and similar to 'scratch' for students that have been involved in CoderDojo.

This activity consists of learning and practicing the drawing commands using an online version of the Turtle Graphics game. At each level students face more difficult pictures to draw. It can be done in pairs, working together to figure out how to solve the problem, figuring out the geometry needed. Students will then have an opportunity to draw with the robot(s) if available, drawing their initials on the take-home sheet.

Through this students are introduced to the basics of programming – simple instructions and basic loops. They learn that combining these can lead to increasingly sophisticated drawings or programs. The game also shows students the formal code that they have 'written' using the instructions in the interface.

Equipment Overview

There are two options for this activity which may also be combined.

The first is to set up laptops or a computer lab with internet access and lead the students through the levels of the Turtle Code game on Blockly Games website:
https://blockly-games.appspot.com/turtle

The second is to set up laptops to program some Mirobots to draw on paper.

Mirobots

- Mirobots can be purchased at http://shop.mirobot.io

- The latest Version 2 costs £50 plus shipping.

- It requires 4 AA batteries.

- You will also need felt tip pens and paper.

- You need a wifi-capable laptop

Equipment - Stand

- Poster + Poster board/wall

- Laptops

- Power sockets.

- Tables and chairs

Preparation

- Play each of the levels of the Turtle Code on Blockly Games.

- Construct the Mirobot (the soldering of the electronics is already done). This takes about 40 minutes, see video, following the instructions on the website:

  http://learn.mirobot.io/docs/building-the-v2-mirobot/

- Practice using the Mirobot with the wifi interface.

- Familiarise yourself with the background information

Set Up

- Set up the laptops/computers with internet if possible.

- Set up the Mirobots by adding the pens and batteries and switching on.

- Connect to the Mirobots over wifi:

  http://learn.mirobot.io/docs/configure-wifi/

- Setup the apps if internet is available.

- Check that the Mirobots are working and drawing well.

Configure the WiFi

Follow the instructions from the website that we have reproduced here.

- Mirobot uses WiFi to communicate, which means the first thing you need to do to use it is to set up its WiFi connection. In this following there are a couple of WiFi networks that are being used:

  - The internal WiFi network of the Mirobot. This appears as an access point that you can join your computer to. This is "Network A"

  - Your existing WIFi network at home, school or work. In the second part of this we will be configuring Mirobot to join this network. This is "Network B".

- It can both have its own access point running and join your network at the same time

Mirobot Interface

- The first thing you'll need to do is to access the built-in web interface:

    - Turn it on. The second red LED should start flashing and should then stay on

    - Once it has stopped flashing you should be able to connect to the open wireless network called "mirobot" (Network A)

    - Once you have connected to the "mirobot" WiFi access point, visit http://10.10.100.254

    - You should see the mirobot interface loading in your browser

To use the apps you need to get it on your WiFi access point (Network B) :

- – Make sure you are able to access the built-in interface on http://10.10.100.254

- – Click on the "Configure WiFi" link in the top right of the page

- – Enter the details for your existing WiFi network (Network B). Click the scan button to find it and the encryption settings should be set automatically

- – Click the "Save" button and Mirobot will restart

- – After 20 seconds, reload your browser and it should say "WiFi Connected" instead

- – To find out what its IP address is, you can click on the "WiFi Connected" link again and see it there

- – Now you should join your computer to your existing network (Network A) again and access Mirobot via this IP address

Demonstration

We provide instructions for a combined activity, adjust to your own circumstances.

- Show the students how to do the first task – drawing a square.
- Challenge the students to do as many levels of the game as they can.
- Let students draw with the Mirobot. You can use the examples from the website: http://learn.mirobot.io/docs/drawing-shapes/
- Alternatively let students experiment or suggest that they write their initials.

Teach

- As the students work, help them out when they get stuck.

- Explain to them what a computer program is – a series of simple instructions that the computer will follow exactly. Just like they are writing for the turtle/robot.

- Show them the 'repeat' option and explain what a 'loop' is in a computer program by comparison.

Background Information

- Programming is how we tell computers what to do. A computer is incapable of thought or insight and can only behave as it is programmed to behave. If we want a computer program to do something we must tell it exactly what to do. It will follow those instructions exactly.

The kinds of things we can tell a program to do include:

- Assignment: We can tell a computer that we want a specific value to be stored and remembered. For example, we might tell it to remember that the screen should be coloured red. We might tell it that we want 5 stars on the screen. We might tell it that we want a star to take 30 seconds to move across the screen. We assign these values to storage areas in computer memory, which we call variables. The program will remember anything which is stored in its variables.

- Control: We can tell a computer that we only want it to do something under certain conditions. We can tell it that we want an object on screen to move if someone clicks on it. We can tell it that we want the colour on the screen to change if it is night time. We can tell it that we want to add points to a player's score in a game if they got the correct answer to a question.

- Iteration: We can tell a computer to do something more than once. We do this by asking it to loop a number of times. We might do this if we want the computer to draw five stars. We might do this if we want the computer to find the highest score by iteratively comparing each of a set of 10 scores to each other. We might do this if we want the user to be asked the same question until they get it correct.

- Instruction: Ultimately, a computer program relies on the simple instructions it is given. These include instructions to print text on screen, to draw lines on the screen, to read in a value from the keyboard or from a database or from a network.

- To create a program we put together code which tells the computer what it needs to remember (assignment), when it need to do things (control), how often it needs to do things (iteration), and what actions it needs to take (instruction). Computer programs – large or small – are just collections of lines of code which tell the computer what to do.