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S4A - Scratch for Arduino Workshop Session Plan

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Workshop Schedule

"By failing to prepare, you are preparing to fail."

Event Set Up	30 minutes	

Introduction

Welcome/Pre-day Forms	5 minutes	(Slide 1)
Introduction	10 minutes	(Slides 2 & 3)

Robots

Draw me a robot	5 minutes	(Slides 4 - 6)
Robots examples	15 minutes	(Slides 7 - 13)

S4A

Introduction	10 minutes	(Slides 14 & 15)
LEDs	30 minutes	(Slides 16 - 18)
Chassis and motor controller	30 minutes	(Slides 19 - 22)
Movement	45 minutes	(Slide 23)
Pen	30 minutes	(Slide 24)

Q&A/Post-day Forms	5 minutes	(Slide 25)
Event Clean Up	30 minutes	

Total: 3 hours 5 minutes for attendees
Total: 4 hours 5 minutes for staff involved

Hardware and Software Requirements

1. Laptops with the following software installed: Arduino IDE, S4A, Technocamps image and Arduino Uno Driver.

2. Arduino for each group which has been flashed with Technocamps custom firmware.

3. Technocamps Pen Bot, complete with Arduino for each group.

4. Technocamps LED board for each group.

Attendee Prerequisites

1. No programming experience required.

2. Scratch experience preferred.

3. Completed consent forms.

4. If under 16, parental permission to upload photos to the website or Facebook page.

Learning Outcomes

1. Familiarity with the Arduino boards

2. To develop programming skills.

3. Basic understanding of robotics and electronics.

4. Improving ICT skills.

Event Set Up and Clean Up

Event Set Up

1. Prepare any pre and post-day questionnaire forms as required. Remember spare pens / pencils.

2. Ensure tables and chairs are arranged to naturally encourage people to sit in groups; ensure no one is sitting with their back to the podium.

3. Test display equipment (e.g. projector) and ensure that presentation and internet connection are working and ready for use.

4. Prepare all hardware for pupils to be given out throughout the workshop.

Event Clean Up

1. Ensure all pre-day and post-day questionnaire forms have been collected if required.

2. Clear up litter and refuse. Remember to recycle where facilities exist. Remember to switch off lights, computers, and projectors!

Introduction

Welcome and Pre-day Forms

The first 5 minutes is about welcoming and encouraging people to complete any pre-day forms before the workshop begins. Also ensure you read through the pre-day forms with the participants to confirm they have been filled in correctly.

Ensure that you welcome the attendees as they enter the room; this helps to create a positive connection.

Introduction

The introduction gives you time to introduce everyone involved with hosting the workshop.

The main aim is to have everyone settled, focused, and filling required forms, e.g. pre- and post-day questionnaires.

(Slides 1 & 2: About Technocamps)

"Good XXX, I'm XXX and I work for a pan-Wales organization called Technocamps.

Has anybody heard of Technocamps before or been to one of our workshops?

We are a £6 million government funded organization getting young adults and children aged between 11 and 19 to become excited about Computer Science and what it has to offer, in both their education and future careers."

Allow time for all students to fill in required forms. Talk through each question and ensure that all questions are filled in.

(Slide 3: STEM)

Discuss with the group their views on Science, Technology, Engineering and Maths. What do the pupils think these terms mean? Or what topics are covered within these subjects? Briefly explain to the group what each term means, talking about the link between each of them and how Computer Science is incorporated into each of the other subjects.

(Slides 4 - 13: Robots)

To begin, discuss with the group what they think Robots are. The task on slide 7 will enable the group to get

creative and design their very own robot: What will it look like? What will it do? How will you interact with it? Discuss with the participants the comparisons in the variety of robot designs and functionalities. Do some of the robots have similar features?

On slides 7 to 12 there are examples of uses for robots within education or even industry, below is a description for each of these:

- Slide 7 - The iCub is a robot used in research to simulate infant learning and to try and mimic that in robotic systems. It has many sensors including cameras, microphones and touch sensors. This is probably similar to many of the robots the students will have drawn but remember to discuss with the group that not all robots will look like humans.
- Slide 8 - An example is an industrial manipulator, used to either work in dangerous places or in a repetitive manner like on assembly lines. They tend to always do the same thing over and over again, which saves us having to do it ourselves.
- Slide 9 - This is Kit from the 80s American TV program. The car would drive itself, talk, think like a human etc. This was science-fiction but nowadays some cars can do things like drive on their own, park themselves and to automatically brake when too close to a detected obstacle.
- Slide 10 - Idris is a research robot used in many projects that have to do with autonomous navigation (driving on its own) in complex environment.
- Slide 11 - BeagleB is the equivalent of Idris but on the sea. Autonomous sailing with instruments used to, for example, measure water quality of listen to dolphins communicate with one-another.
- Slide 12 - Is a washing machine a robot? What does the group think? Why? Why not? Many believe they are robots, as they can be programmed to do different things (different settings for different fabrics) and they sense their environment (temperature, water level, amount of detergent etc).

Once you have gone through this with the group, discuss what actually makes them robots. Is it their appearance or the embedded computers? Robots are devices that sense the environment they are in and what it is doing to them and in particular how the robot can react accordingly to how they are programmed.

(Slides 14 & 15: S4A)

To begin introducing Scratch For Arduino, describe the different elements of the S4A interface. On the left is where the code blocks are stored, ready to be dragged into the central area in order to build up a script. On the right is the screen for the Arduino and below that is the library for all the sprites. You can see that the Arduino board is saved as a sprite. This is where you will be programming the robots, it looks the same as Scratch, apart from a variation in code blocks available, please see the Top Tips for more detail.

S4A- Scratch for Arduino

(Slides 16 - 18: LEDs)

Hand out the Arduino kits and LED kits to each group. Discuss each piece of kit they have been given but DO NOT go through the pins on the Arduino until the pupils have tried to get the LEDs to light by themselves. Show the pupils the "Digital on and off" blocks on Slide 16, ask the participants to drag these onto their project and double click them to make them turn on and off. Once this is successfully working for everyone, ask the group to try and get their LEDs to flash continuously. To achieve this, code similar to the code on the right hand side will need to be implemented, once the group are ready to move on then show this solution and explain to the group how it works.

On Slide 17, you will find the breakdown of the pins on the Arduino. Explain to the participants that in order to interact with components like LEDs, the Arduino needs to send out signals to them via these pins. Ask the group to have a look at the wires going to the LEDs and see that they are connected to "Pin 13" and to the GND (which stands for "Ground").

The LED is plugged into Pin 13, explain that this is why we send a signal to pin 13 using the Digital "13" block. It is important that the pupils at this stage recognise this, it will be essential as the workshop progresses onto using the motor controller that will need to talk to the Pins associated with each motor.

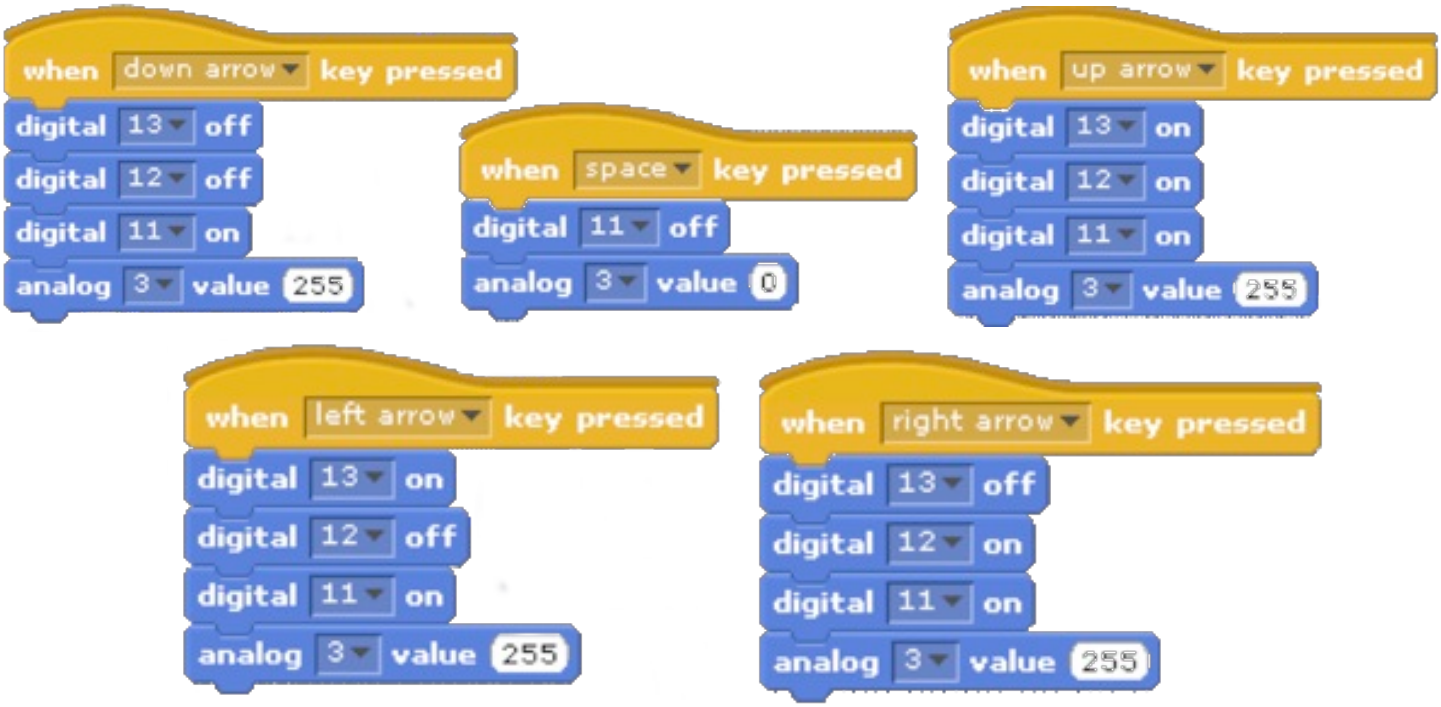
Now that the group have achieved an understanding of how the Arduino works, test this by asking them to use the button on their board to control the flashing LED. The button is plugged into Digital 1 so they should use the block that is an "IF" statement. Enable the group an opportunity to try this out, followed by the solution on the left.

(Slides 19 - 23: Motor Controller)

Hand out to each group the chassis, ask the pupils have a look at this kit and become familiar to it. Unplug the LED circuits and put the Arduino on the provided Shields. Discuss with the group each of the components on the chassis, what do they think they do? Is there any they recognise?

Take a look at the motor controller, as you can see on Slide 21 the motors are both wired onto the shield, in the ports A and B. A battery pack is also wired into the over port of the shield. The Pins on the motor controller are explained on Slide 22. Each motor has a direction that it is spinning and also a power for how fast they are spinning. Firstly, the direction of the motors will need to be set, so it is known which way to move then the

motor will need to have power applied to actually move. See if the group can get their robot to move forward. Once this has been achieved, ask the group to get their robots to also move backwards, left, right and stop (solutions are below):



(Slides 24 & 25: Pen Movement)

Pupils will first need to wire in their servo to the motor shield, following the schematic on Slide 24, wiring the servo into "+5v", "GND" and "Pin 8". Then use S4A to interact with Pin 8 to move the pen up and down, following the solution below:

Once the group has successfully achieved this stage, ask the group to complete the "Post-Day" forms and hand back to the Workshop deliverer.

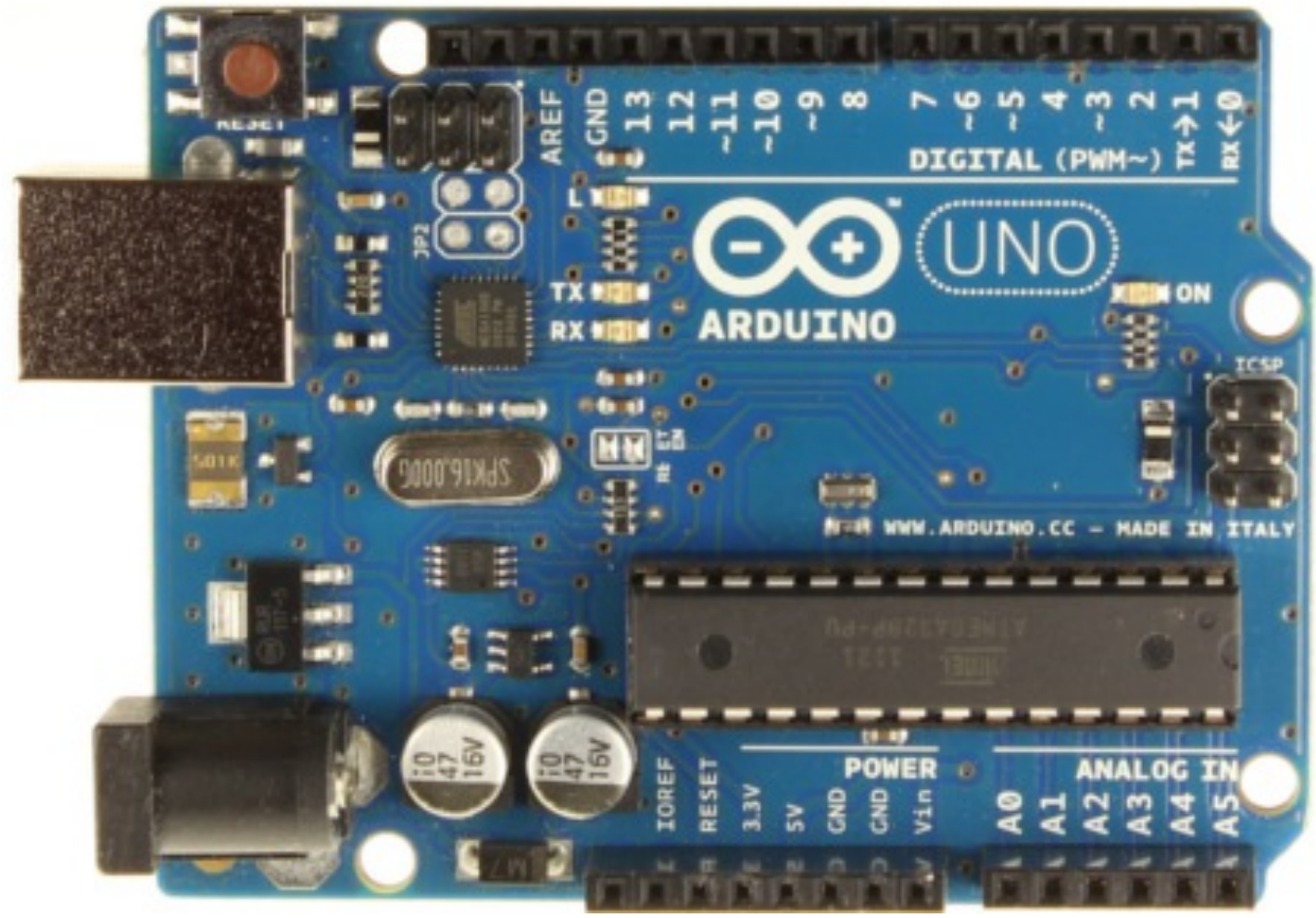
Q&A Session & Closure

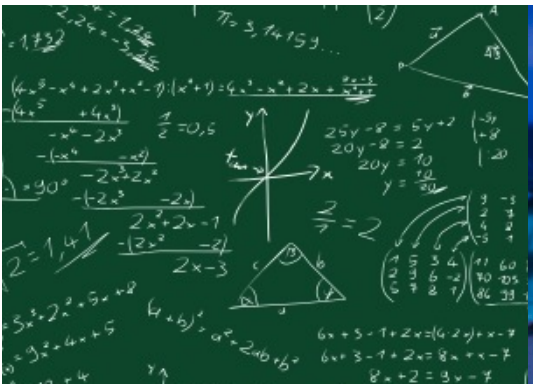
(Take several questions from the attendees)
(If no questions are asked by attendees, begin summarising topics covered)

Once an appropriate number of questions has been taken, you can then begin to close the workshop. Be sure to have any post-day questionnaire forms filled in by attendees as required. Some audiences may require more prompting to fill in such forms.

Closure and Post-day Forms

The last 5 minutes of closure must be used to, if required, ensure that post-day questionnaires are filled in by the attendees and talk them through the information they have filled in. Ensure that you collect all of the post-day form in before attendees depart, and be sure to thank each person for taking the time to fill in the forms.





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