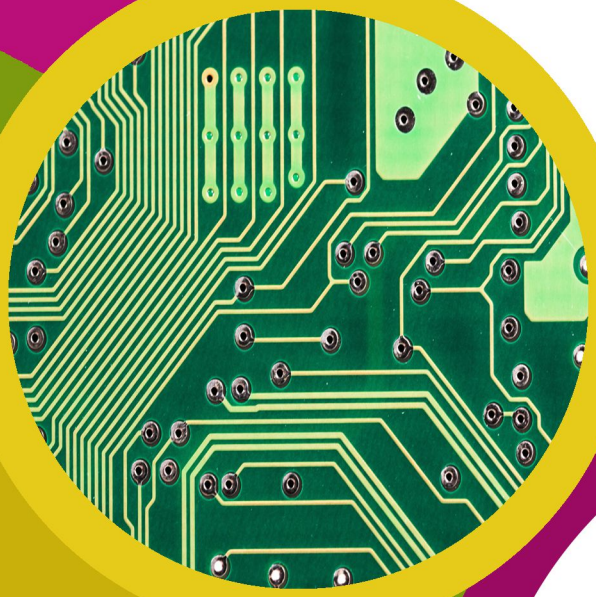
technocamps

Technology, Ethics & The Future Session Plan



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Workshop Schedule

Introduction - 10 minutes

Technology, Uses and Effects - 10 minutes

Evolution of Tech - 20 minutes

Present Day Technologies - 10 minutes

Smart Home and Cities - 30 minutes

Arduino - 2 hours 30 minutes

Future of Tech - 30 minutes

Conclusion - 10 minutes

Post-Day Questionnaires - 10 minutes

Note: These are estimated times, these will vary between classes, schools etc. so times will need to be adjusted accordingly.

Total: 4 hours 40 minutes

Preparation

1. Print out workbooks, one for each student.
2. In pairs students will need an Arduino and some basic circuit materials.
3. In pairs students should have a computer with Arduino IDE installed.

Learning Outcomes

1. Improved awareness of ethical issues surrounding technology.
2. Basic understanding of Arduino circuits and code.

Attendee Prerequisites

1. Basic programming experience - e.g. Scratch

Session Plan Key

In this session plan we use the following colours to differentiate the types of activities:

- **Yellow - Explain.** Teachers should explain the slide/example to the class.
- **Green - Discuss.** Teachers should start an open discussion with the class to get them to feedback some answers/ideas.
- **Purple - Activity.** Students are expected to complete an activity whether it be in their workbooks or on the computer, followed by a discussion of their solutions.
- **Green - Introduction/Conclusion.** The introduction/conclusion is also colour coded green. Teachers should hand out materials in the introduction and conclude the day and collect materials at the end.

Introduction

Begin with introductions, and a brief explanation of the Technocamps programme, before handing out pre-day questionnaires to be filled out by the students and teacher.

Activity: What Is Technology?

Ask students to write their own definition and description of technology in their workbooks. Encourage them to consider the variety of technology and devices they use daily before writing a definition.

Explain: Technology Definitions

Ask students to provide their definitions before showing them the actual definitions from the dictionary.

Explain: Ethics

Explain the concept of ethics to the class.
Ethics is about doing the right thing.

When considering if something is ethical we must consider:

- Impact: Who does my decision affect or harm?
- Fairness: Will my decision be considered fair by those affected?

Activity: Technology, Uses and Effects

In pairs, students should write a list of devices they use and their effects in their workbooks. They should consider the device itself, what they use it for and whether that affects anyone negatively or positively, including themselves.

Discuss: Technology, Uses and Effects

Ask students to provide their answers to the class and see if others agree or disagree. Propose some examples to the class (see slides).

Explain: What Did We Use Before?

Explain each object on the slide and their use/purpose to society, relating each item back to a current day alternative.

- Record player - Entertainment - Now: Youtube/Spotify
- Marbles - Entertainment - Now: Online games
- Abacus - Mathematics/studying - Now: Calculator
- Pigeons - Send messages - Now: Phones
- Books - Learn/Entertainment - Now: Google/Kindle

Explain: How Has Technology Evolved?

Explain each slide to the class highlighting how far technology has come!

- The First Programmable Electronic Computer
- The First Computer with RAM
- The First Laptop
- The First Apple Computer
- The First Mobile Phone

Explain: Present Day Technologies

Highlight the main differences between present day technologies and their first editions. For example:

- The first laptop was much bigger than laptops nowadays.
- When you buy a computer you expect the whole thing to be assembled and not just the insides!
- Mobile phones have gotten much smaller and lighter although now they are creeping back up in size!
- Touchscreens are a relatively new idea - when the idea was first considered people thought it was crazy. No-one would ever want to cover the screen with their hand, they want to see everything constantly - how wrong were they?!

Explain: The Internet of Things

Explain how the internet of things has affected our daily lives in such a huge way!
The interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.
Lot's of everyday objects are now internet enabled.

Discuss: Present Day Technologies (Continued)

Present the next few slides prompting the students to think about how we use these devices/pieces of technology and why we use them.

- Amazon Alexa/Google home - personal assistant
- Smart watch - track fitness, connect to phone applications
- Smart fridge - reorder items when low, keep track of stock
- Bins - do **not** give this answer.

Activity: Bins - How Do They Use Technology?

Students should write in their workbooks how they think bins use technology.

Discuss: Smart Technology

Smart technology is a buzzword these days but it can sort of be categorised into three parts! Explain the three parts - smart devices, smart connected devices and IoT devices. Use the slides for more information.

Discuss: Smart Homes and Smart Cities

Considering what the students just learnt about smart technology ask them how many of them have smart devices at home. How many use the devices daily? What do they mainly use them for? What do smart cities and smart homes offer us in general?

Explain: Smart Homes and Smart Cities - Bins

Revisit the earlier activity and ask students what they wrote.
Explain how bins can actually be smart and sense when they are almost full. When almost full a message can be sent to the bin collectors who would come out to empty them. This saves time from being wasted checking bins which do not need to be emptied.
Some bins can also sort rubbish into the correct recycling bin.

Discuss: The Great Fire of London

First set the scene of the great fire of London. It was 5 days longs Sunday through to Monday in September 1666. It consumed 13,200 houses, 87 parish churches, St Paul's cathedral and most of the buildings of the City authorities. It is estimated to have destroyed the homes of 70,000 of the city's 80,000 inhabitants. The death toll is unknown but was traditionally thought to have been small, as only six verified deaths were recorded. This reasoning has recently been challenged on the grounds that the deaths of poor and middle-class people were not recorded; moreover, the heat of the fire may have cremated many victims, leaving no recognisable remains.
Pose the question to the students of how technology could have helped in this situation. Once some answers have been provided proceed to discuss how smart fire alarms could have been installed. They could have automatically alerted authorities and neighbours.

Explain: Deliveries

Explain how Amazon have a service that allows delivery drivers to enter your home.
When a courier arrives with a package for in-home delivery, they scan the barcode, sending a request to Amazon's cloud. If everything checks out, the cloud grants permission by sending a message back to the camera, which starts recording. The courier then gets a prompt on their app, swipes the screen, and voilà, your door unlocks. They drop off the package, relock the door with another swipe, and are on their way. The customer will get a notification that their delivery has arrived, along with a short video showing the drop-off to confirm everything was done properly.

Discuss: Deliveries

Pose the question of who would use this kind of service. Ask students if they can see any issues surrounding the service.

Discuss: Issues

Pose the question - what if someone hacked Amazon? Can we imagine all of the doors in a street just swinging open by themselves? How scary is that?! What about the camera system? What if someone exploited that?

Explain: Issues

Explain how Amazon Echo has been faced with some privacy issues. People fear the device is constantly listening. The article attached demonstrates that the Echo just misheard a few phrases in a row and Amazon are working to resolve any such issues from happening again.

Explain: Issues

Ask the students how many of them actually trust smart devices? Continue to explain the article highlighting key details:

- 22% of the 1,000 adults surveyed said they leave the room or lower their voice so the smart speaker can't hear them.
- 48% believe technology is always listening.
- Many people are not using the devices to their full potential due to trust issues.

Activity: Benefits and Drawbacks

Students should list in their workbooks some benefits and drawbacks of smart homes and smart cities - encourage them to come up with their own ideas thinking out of the box. Consider both functional benefits as well as the ethical issues.

Explain: Arduino

Now the students will make their own smart lights using Arduino. An Arduino is an open-source electronic prototyping platform enabling users to create interactive electronic objects.

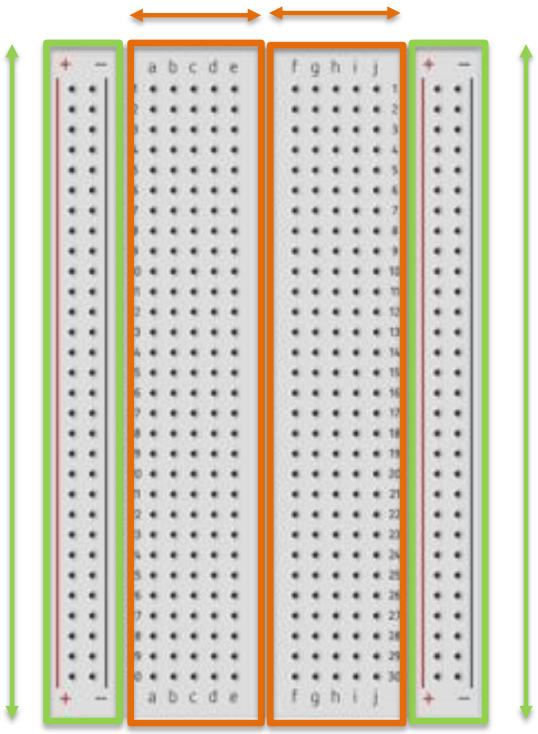
Explain: Circuit Components

Highlight the name of each components. These will all be used to make our smart light. Explain how there are numerous sensors that can be used with an Arduino and explain some uses for these sensors.

Explain: Breadboard

This is one of the most important things to understand when making your Arduino circuits. The connections run both vertically and horizontally.

E.g. anything connected in the + column is connected to one another vertically.
However with the lettered columns a-e and f-j, the connections run horizontally. So a wire in a will be connected to a wire in e.



Activity: Tinkercad

Students are to navigate to www.tinkercad.com/joinclass.
Provide them with the class code (you should have previously set up a class). Assign a number to each student. They should append the number to technocamps to form a nickname they can use to log in. Once logged in students need to create a new circuit.

Activity: Tinkercad Arduino Circuit

Students need to create the circuit on tinkercad. You may need to demonstrate how to rotate the components (click on them then use the rotate button in top left.). To create bends in the wire double click to create points that can be moved.

Activity: The Code - Variables

Explain how we can use variables in code to assign names to values. These can be text and numbers. Students are to match up the variable to the correct type in their workbooks.

Explain: The Code - if statement

Now the students need to use an if statement to check if low light level is detected.
Pose the following statements to the students:

- "If you are wearing a jumper stand up"
- "If you have blue eyes clap your hands"
- "If you have green eyes, act like a chicken, otherwise act like a cow"

Explain that the first 2 statements were **if** statements, and the last was an **if else**.

Activity: Tinkercad Code

Students should utilise the blocks available in the Tinkercad code editor to complete the task in the slide. The solution is available in the slides also.

Activity: Arduino Circuit

Students are to make the circuit in pairs ensuring they copy exactly the circuit in the slides. If there are any issues then the whole project will not work so make sure they check with one another that the circuit is correct.

Explain: The Code

The Arduino language is C/C++ which is a programming language used worldwide by experienced developers. Highlight the income of the developers. We can use variables, methods and code to produce different outputs.

Activity: The Code - Variables

Explain how there are different subtypes of each main type in code. Text is called String. Numbers can be separated into Integers, Long, etc. Perhaps provide some examples of the differences to a more experienced class.

Show students the example Arduino code highlighting the structure. The semi-colon at the end of the line is essential!

```
type name = value;
int sensorPin = 0;
```

Also highlight the green is comments which we can include in our code to ensure we understand what is going on. Students must copy the code.

Explain: The Code - Methods

Explain how when we are programming in Arduino we need to use two methods: setup and loop.

Methods are instructions to our code. For example if we had a dog we could tell the dog to sit, lay down and give paw. The instructions in our methods simply tell our computer what to do.

Activity: The Code - Setup

The setup method is where we "set up" the Arduino ready to interact with the circuit.
In our setup method we will be using a serial. `Serial.begin(9600);`
A Serial provides us with a way to transfer data between the Arduino and our computers.
`pinMode(lightPin,OUTPUT)` sets the lightPin (2) to be an OUTPUT for our code.
Students should copy the code into their Arduino development.

Explain: The Code - Loop

Explain how any code inside the loop method will "loop" **forever** until the Arduino loses power.

In our code firstly we will read the data from the sensor pin and print it out. This allows us to debug the amount of light in the room and alter our threshold later on. analogRead is a built in Arduino function that we can use to retrieve this data.
`Serial.println(sensorValue,DEC)` prints the sensorValue to the monitor on our PCs.

Activity: The Code - Loop

Students should write the code we've learnt so far and test their Arduino's using the monitor.
In the workbooks students must answer: What value range does the sensor print out with normal room lighting? and What value range does the sensor print out if you slightly shield the sensor? They will have to use the monitor to get the answer. If the circuit or code is incorrect students will not progress.

Explain: The Code - if statement

Now explain the way to write an if statement in code:

```
if (condition){
    // perform this action
}
```

Explain the next two slides of code highlighting the if statements. First of all we check whether the sensor is below (<) the threshold and then we check whether it is above (>) the threshold; If it's below, then we turn the LED on - HIGH, if it's above we turn the LED off (LOW).

```
digitalWrite(lightPin, HIGH);
digitalWrite(lightPin, LOW);
```

Activity: The Code - if statement

Students should write the code inserting the two if statements into the loop. They need to remember the values that was useful to them and their surroundings and adjust the threshold value accordingly in order for their smart light to work effectively. E.g. if the sensor prints 300+ with normal lighting and less than 300 when shielded, then they need to change the threshold from 400 to 300.

Activity: Other Arduino Circuits

Students can select which circuit to make and copy the code for it. If students manage to complete it quickly then they can try and make another circuit or perhaps experiment using Tinkercad.

Discuss: The Future of Tech

Discuss each of the devices/pieces of technology on the slides. Ask students first if they know what the device is/does. Let the discussion lead the conversation, moving on the the next item when appropriate.

- Google glass
- Oculus Rift
- Driverless Car

When you reach the driverless car slides with video links watch the videos before moving onto the activity.

Activity: Driverless Cars - What Do They Do?

Students should write in their workbooks all of the things that a developer of a driverless car has to consider. For example:

- What should the car be able to do without any assistance?
- What sensors should they use?
- What should the car do in emergencies?

If needed students can use the internet to research.

Discuss: Driverless Cars - Issues

Discuss who the students think is responsible for accidents that occur that include a driverless car. Would it be the car owner, the manufacturer, the developer, or even the pedestrian? Get them to consider if there should be a law in place to prevent these kind of issues arising when driverless cars are made available to the mass market. Perhaps make a mind map on the board of each students suggestion/thoughts.

Discuss the decisions that the car would have to make. What if there was an unavoidable collision - who should the car save? The driver, passengers, pedestrians, the other car? Again ask students for their opinions and perhaps do a toll keeping track on the board.

Activity: Driverless Cars - Issues

Show the students the animation of the driverless car and the pedestrian on his phone. Once the students have watched the animation they should write in their workbooks what issues they think exist with driverless cars. Prompt them to think about accidents, making decisions and responsibilities.

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