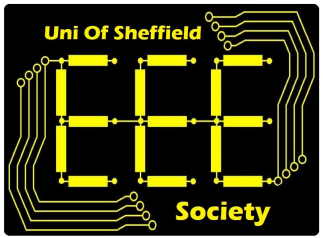
UOS EEE Society - Arduino Labs

Further Programming



The University Of Sheffield.

Session Overview

1. Control Statements and Loops
2. Functions
3. Arrays and Strings
4. Libraries
5. The Arduino Editor
6. Debugging using the Serial Monitor
7. Online Resources
8. The LED Shield we are using in Labs!

Control Statements

Statement Name	Statement Syntax	Description
if	if (statement) {}	If the statement is true, do the action.
else	else {}	Else do the action. Must come after an if statement.
else if	else if (statement) {}	Else if the statement is true, do the action. Must come after an if statement.
switch	switch (operand) {} case value:	Checks whether the operand is equal to one of a set of cases. Sometimes referred to as a “switch case” statement.

Loop Statements

Statement Name	Statement Syntax	Description
for	for (once before, when to end, once per cycle) {}	Complete the [once before] statement. Then loop until the [when to end] statement is true and complete the [once per cycle] statement once per cycle at the end.
while	while (statement) {action}	While the statement is true, complete the action.
do while	do {action} while (statement)	Do the action while the statement is true. Unlike “while” this loop always executes at least once.
Nested Loops	N/A	Loops within loops. Useful for moving through two dimensional arrays.

Functions

- Functions are a way of defining a set of statements that can then be **called** again at multiple points in a piece of code.
- They are very useful when you want to perform the same task multiple times in a piece of code.
- They also help to make code more **maintainable**, which is extremely important in industry.

In Arduino, functions are **defined** like this:

[return type] [function name] ([argument one], [argument two], …) {[statements]}

Arrays

- Arrays can be thought of as lists of variables.
- They must be filled with values that comply with their defined type.
- Arrays can be indexed.
- **Ultimately this makes them useful for storing sets of similar information to LOOP through.**

In Arduino, arrays are defined like this:

```
type array_name[array_length] = {array_values}
```

Arrays can be indexed like this:

```
array_name[index]
```

Strings

- **Strings are just text, for example “Hello World” is a String!**
- Unfortunately Strings in Arduino can get a little confusing, as there are two ways of implementing them; a character array or String object.
- A character array:
  - Is an array.
  - Contains the characters that make up the String at individual indexes of the array.
  - Must have a null terminator at the end of the String ⇒ “\0”.
- A String object:
  - A construct that contains data and functions.
  - In this case all of the data and functions are about text.
  - The String object allows for more complex operations to be performed on the text.

Libraries

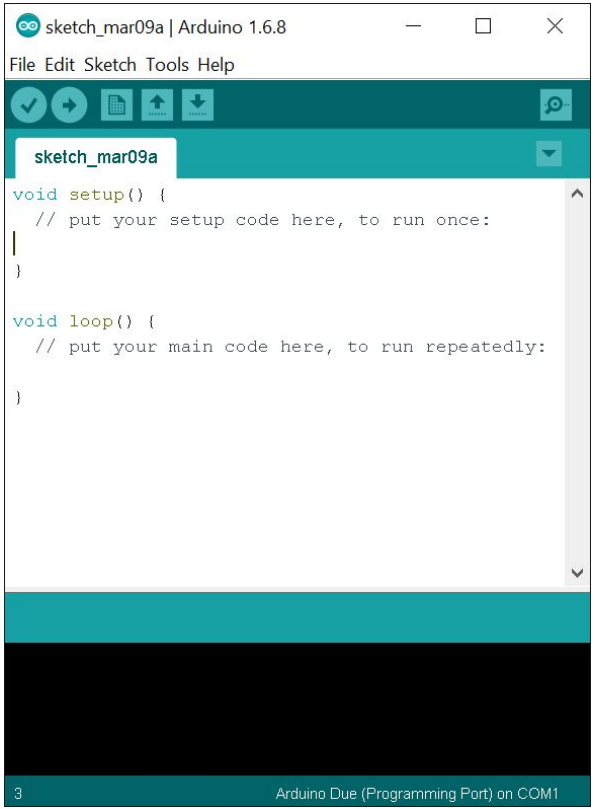
- Libraries contain a pre-written set of functions.
- Usually these functions are designed to perform one task.
- They are very helpful when interfacing with commonly used hardware that may already have a library written for it.
- You can write your own libraries. This can be useful if you have a set of functions that you use very commonly.

Libraries are **imported** in Arduino as follows:

```
#include <library_name.h>
```

The Arduino Editor

Let's take a brief look at the Arduino IDE (Integrated Development Environment)!



Debugging using the Serial Monitor

- **Arduino code can be debugged by sending print statements to the Serial Monitor.**
- These statements can be sent using the Serial library. Some of the functions the library contains are:
  - begin()
  - print()
  - println()
  - read()

We will briefly look at some example code!

Online Resources

- Software is amazing because you can do so many things with it.
- This is largely due to the number of functions that it has built in or that people have added with libraries.
- This is where online resources such as the Stack Exchange, Stack Overflow and Arduino Forum are invaluable.

If you are trying to solve a particular problem with your code, chances are someone has solved it before.

Enough of the boring stuff!

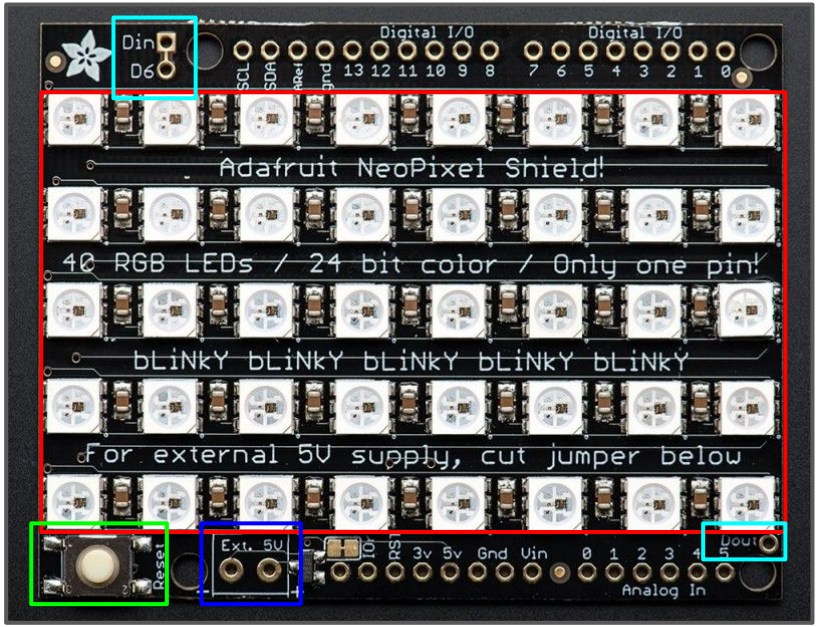
The Adafruit Neopixel Shield

40 Neopixel LEDs - 40 Addressable RGB LED modules. These LEDs can be configured using RGB packets sent serially. **This means all 40 LEDs can be controlled using 3 pins.**

External 5V Connector - Allows the connection of external 5V Power.

Reset Button - Resets the Arduino controlling the Shield.

Din/Dout Pins - Allows multiple neopixel shields to be chained together and controlled by one Arduino.



What have we learnt today?

- Control statements can be used to manage the flow of code.
- Loop statements can be used to perform a set of operations multiple times for different values.
- Functions define a set of operations/statements that can be called at multiple points in the code.
- Arrays are lists of variables. They are very useful for accessing sets of similar information.
- Libraries can be used to employ pre-written code to perform complex tasks.
- The Serial Library is very useful for debugging purposes when used with the IDE Serial Monitor.
- Online Resources like the Stack Overflow can be used to indicate the best way of solving a problem or fixing a bug.

Quiz Time!

Functions make code more:

Libraries allow you to:

Use pre-written functions in your code

Loan books for money

Look like your working but really your watching cat videos

What are the Serial Library and Monitor useful for?

What are arrays?

Collections of data of different types

Collections of data of the same type

An individual piece of data

Control statements allow you too:

Loop a set of operations multiple times

Control the flow of code based upon certain parameters

Control the flow of code based upon no parameters

Loop statements allow you to:

Control the flow of code based upon certain parameters

Loop a set of operations multiple times

Say the same thing over and over again

Where should you go if you have an issue?

Complain to someone else about how code never works and

Stare at the board until things start working

Search your issue on the Stack Overflow

Search your issue on Google

Hacksheffield 4.0

- This is a brilliant event to test your new Arduino skills!
- The EEE Society has exclusive access to 15 tickets ⇒ tickets will be available this week.
- For more information please visit the Hacksheffield Website!

Thanks for listening!

Next week we will be:

1. Looking at a simple program to make random colours appear on the Neopixel Shield.
2. Writing a simple program to make YOUR country's flag appear on the Neopixel Shield.

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