

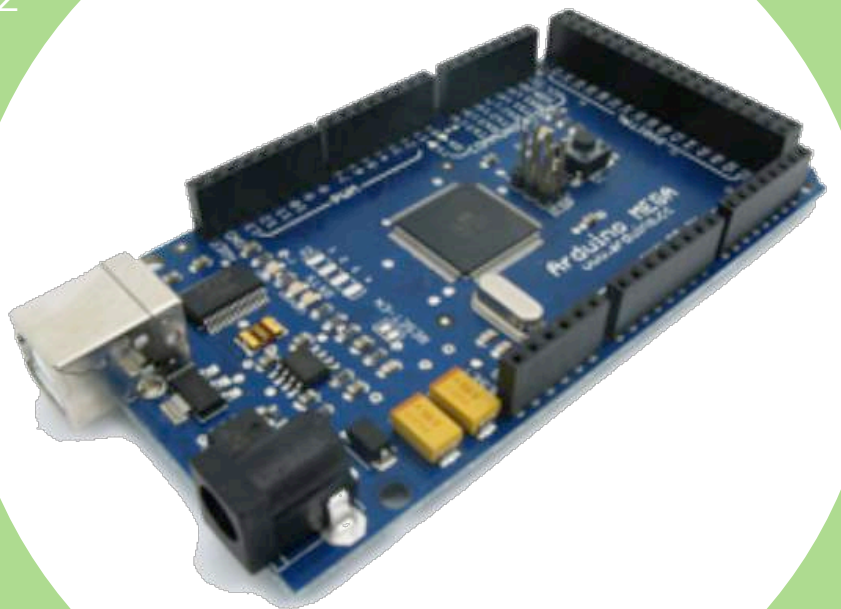
DE0976
Experiential
Design

World of Music

Sophie
Tyler

Content

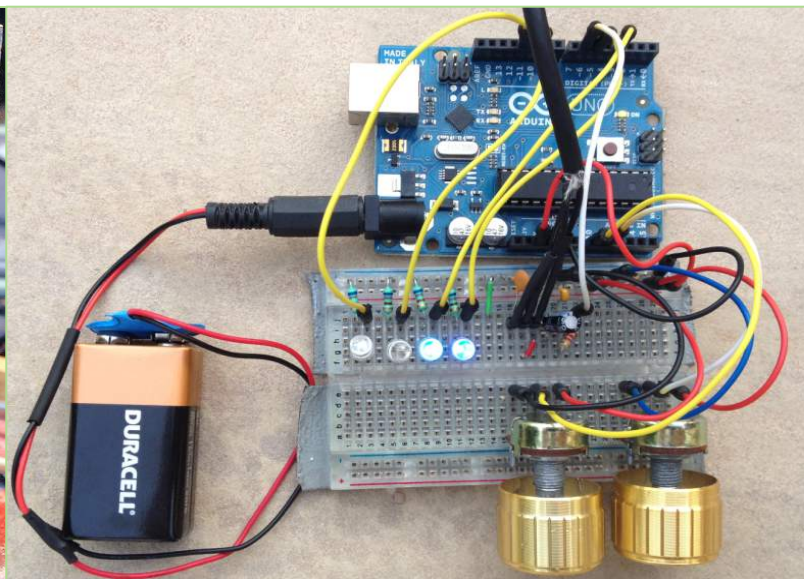
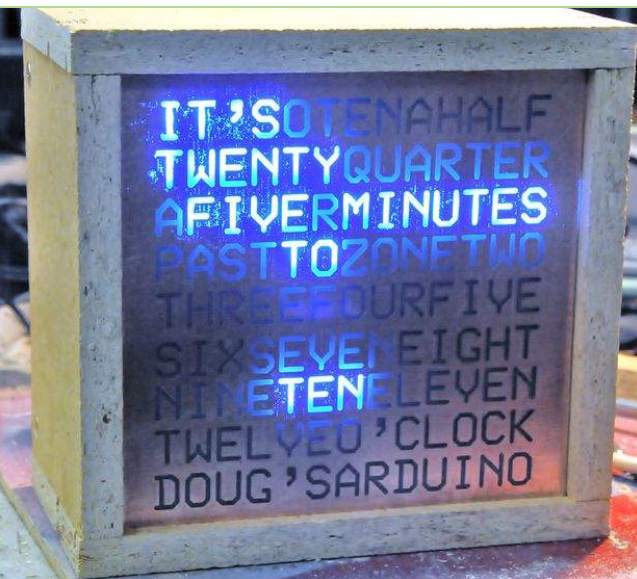
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Brief

I was given two briefs initially for this projects. Option 1 was to design a thought provoking audio/visual piece designed for projection in public space. This could be either large scale (i.e. projected on to buildings) or perhaps something that could work well an exhibition space. Option 2 was to create a sensor-based interface to allow users to interact with an audio-visual environment. This could be based on a physical-computing model using tools such as the Arduino system.

After doing research into the programs I would have to use to create either project I have decided on Arduino. I choose Arduino because it is an interesting piece of equipment which after research I realised had a lot of potential giving me a very open brief for my project. I also choose Arduino because I wanted the challenge of a physical product at the end especially with the new added element of Arduino.



<http://www.instructables.com/id/The-Word-Clock-Arduino-version/>

<http://edition.cnn.com/2012/04/20/world/europe/buckingham-palace-art-projection/>

<http://3.bp.blogspot.com/-23tt-i6ETa0/UDk7SE0gcXI/AAAAAAAAAd4/KqAK8tUV9sk/s1600/illutronBuilt.PNG>

Research

After deciding that for my project I will be using Arduino I started researching into projects that have used Arduino. The projects I specifically looked at to research was projects involving sound and light.

Innovative projects using Arduino also interested me especially projects that have a purpose and are not just to give something a try. I used the site called Instructables with there Arduino section to research the projects.

Magic Light (Capacitance Sensor)

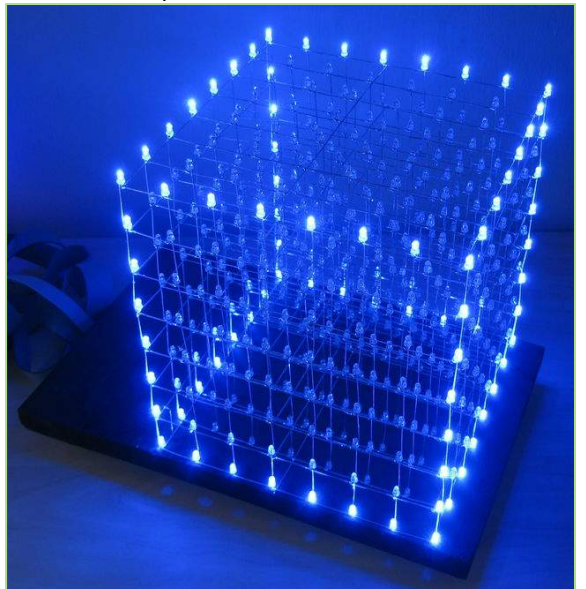
This project was a simple projects that I found which is good for beginners to Arduino. What the light does is that when a user puts there hand near the foil outing it sets of the sensor which will depending on how far the hand is from the light depends on the colour of the light. This project as well only used very cheap equipment minus the initial Arduino with just wires, LED's and foil. The casing as well is made out of an old jar and cardboard tube. The way this project is put together helps show me that when



I start designing my project I will have to think a lot about the material and methods I could use to make the project as cheap as possible.

LED Cube

Unlike the project above the LED cube is a more advanced project for users. A collection of 572 LED's are soldered together to create a cube which when programmed using Arduino creates an innovative light display. The cube uses extensive material and skills to create but the final product is one that impresses many. The use of simple LED's shows how much creative thinking can make a beautiful product.



Research

Midi Draw Keyboard

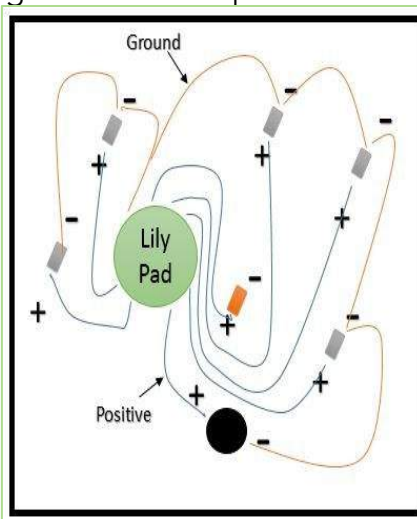
Midi Draw is a simple low cost projects which beginners to Arduino can do quite easily. The main supplies need for the project are an Arduino Uno, USB cable, jumper wires, paper graphite pencils and a computer which has the right programs including Arduino sketch. By following the step by step instructions the user can create a keyboard using paper and paper alone which works using a touch sensor. This simply touch sensor is an idea I might explore more when creating the concept for my final product using Arduino.



Singing Olaf Bag

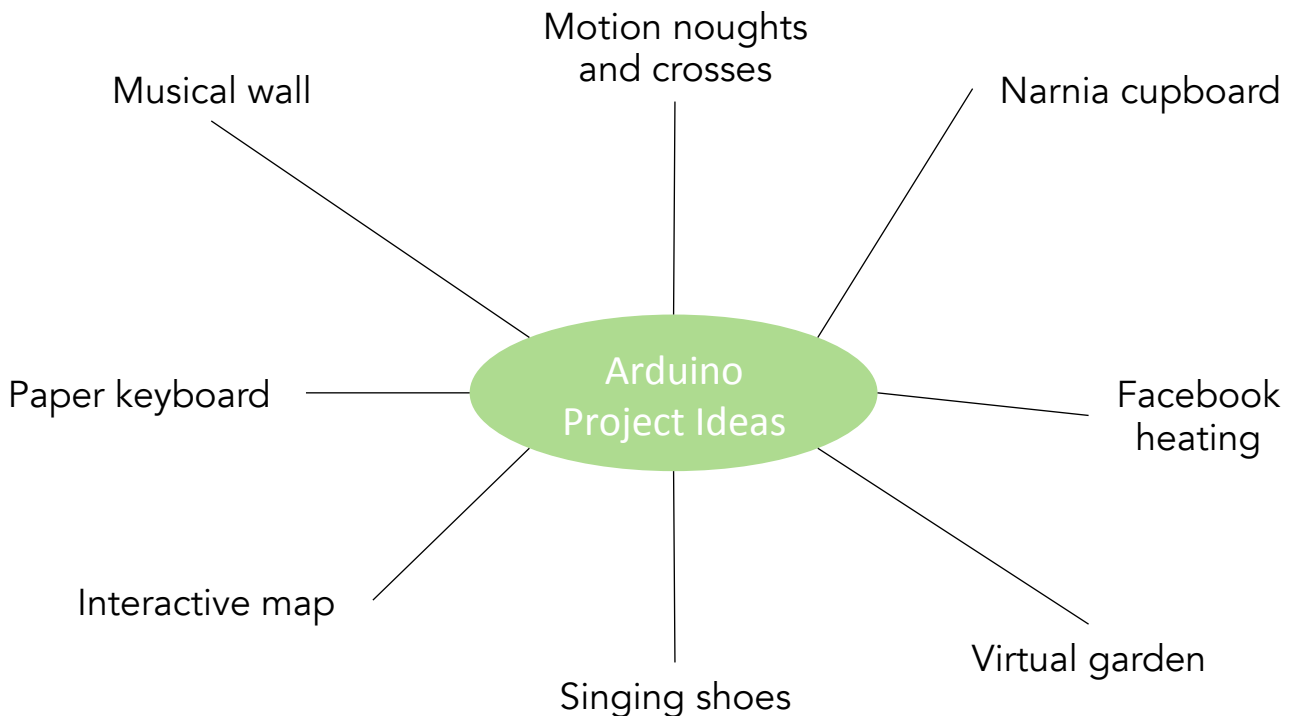
This singing Olaf bag I liked very much because of the way the Arduino and sensors are hidden to create a magical bag which appeals to children. The bag is made using a simple blue bag with cut out pieces. The electronics is created using LilyPad Arduino

simple board, 5 white lilypad LEDs, li-po battery, conductive thread, lilypad button board, lilypad buzzer, lilypad FTDI basica, FTDI driver and Arduino IDE.



Brainstorm

The brainstorm below is the first ideas I had for this project. I then narrowed them down to 4 possible projects which could potentially work after I did some research into the Arduino system.



- Musical Wall- this would be a projection project which when the user moves the right way in front of the screen a brick on the wall projected will light up and play music different motions will set off different bricks.
- Paper keyboard- this idea is inspired by the midi keyboard but the type of keyboard I would create is a typing keyboard which would then be displayed on the computer.
- Interactive map- this map would have LED's and touch sensors which when activated the LED would light up and sound will play. The map could be from a fantasy series or a map of the world.
- Singing shoes- this is a fun idea where the user has shoes which when they activate certain pressure points while dancing will activate music.
- Virtual garden- this is a projection project with the user activating motion sensors changing the view on the screen to make the garden grow.
- Facebook heating- this project will have the user use Facebook and Arduino. When a user sends a message to a certain Facebook page this will turn the heating on in a home for when the user gets home.
- Narnia cupboard- this project will have a cupboard which when opened inside will display LED displays which are triggered when the cupboard door opens.
- Motion noughts and crosses- using LED displays two users can set off motion detectors changing the led display in the shape of a noughts and crosses grid. With certain movements two users can play.

First Concepts

After deciding that to create my final product I would use Arduino Uno I started sketching ideas for my product. Once I had the idea I then did research into its possibility using the extensive Arduino sensors and systems I could use.

The four final concepts which I found most likely are shown below with details on the research I conducted into the possibility of the product.

The Music Wall

The first concept is the idea of using a projector onto a screen showing a brick wall sensor is then above the screen. When a person moves in front of the sensor it triggers the computer to change the screen so that one brick is lit up and music is played. Several possible movements would be programmed into the Arduino sensor lighting different bricks and playing different music.

When I researched into the possibility of this concept I found it probable with the use of a PIR motion sensor which works depending on the distance of the object from the sensor. As well the music element can be achieved

using either a processing program using the computer or an Arduino wave shield.



Narnia Cupboard

The concept for the Narnia cupboard is by creating a cupboard when a door is opened a new world is inside each cupboard. This would be done for example using the four seasons for summer LED's would make the sun and for winter a fan would blow fake snowflakes. When I researched into the possibility I found that it is possible with many Arduino sensors and products available and the possibility to attach fans and other electronic items easily. The only problem with this idea is narrowing down what is to be in the cupboards.



First Concepts

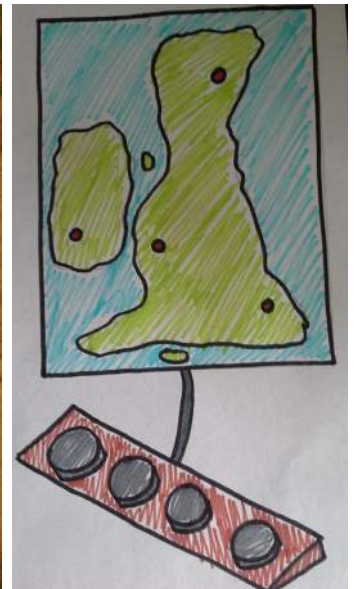
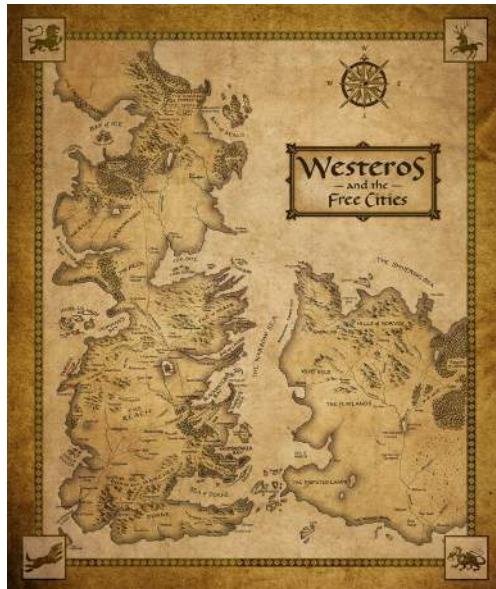
Virtual Garden

The concept for this design is very similar to the Musical wall with the use of motion sensor and projection. The user would trigger the motion sensor which would change the screen as the motion sensor is triggered more a virtual garden will begin to grow. The PIR motion sensor is the Arduino product I would use for this concept.



Interactive Map

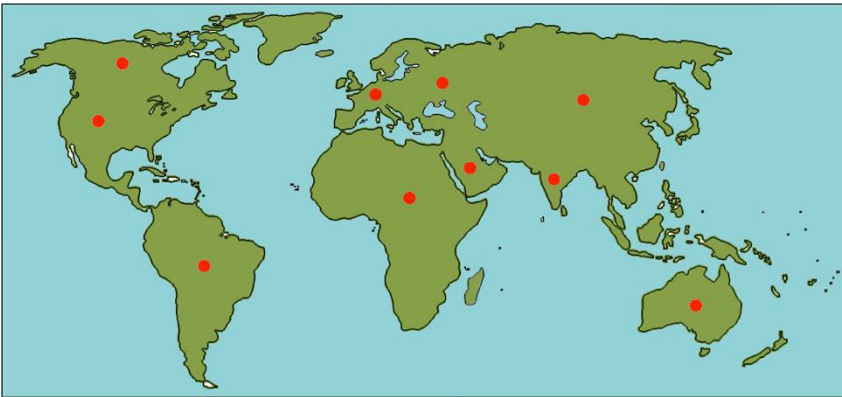
The final concept I created is the interactive map this would use touch sensors like foil and even graphite pencil to create a map which would light up LEDs on the map and play sound. The potential for this product is that it could be a very useful tool when promoting well known fantasy series or books which use a map such as Game of Thrones and Lord of the Rings.



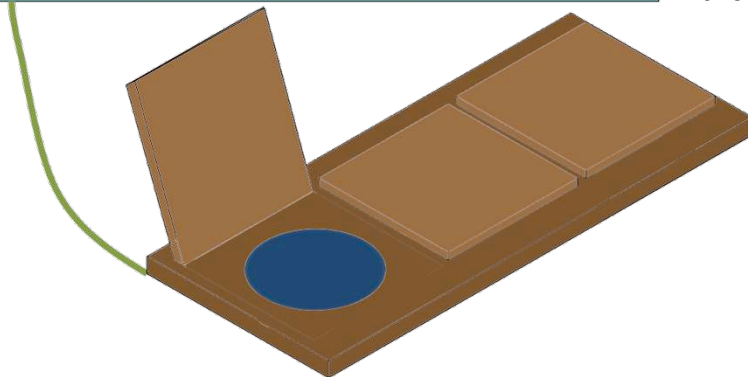
Development

After doing research into the four final concepts I looked at I decided on the interactive map as my final idea. As well I decided on using a map of the world which would then play traditional music from the different continents.

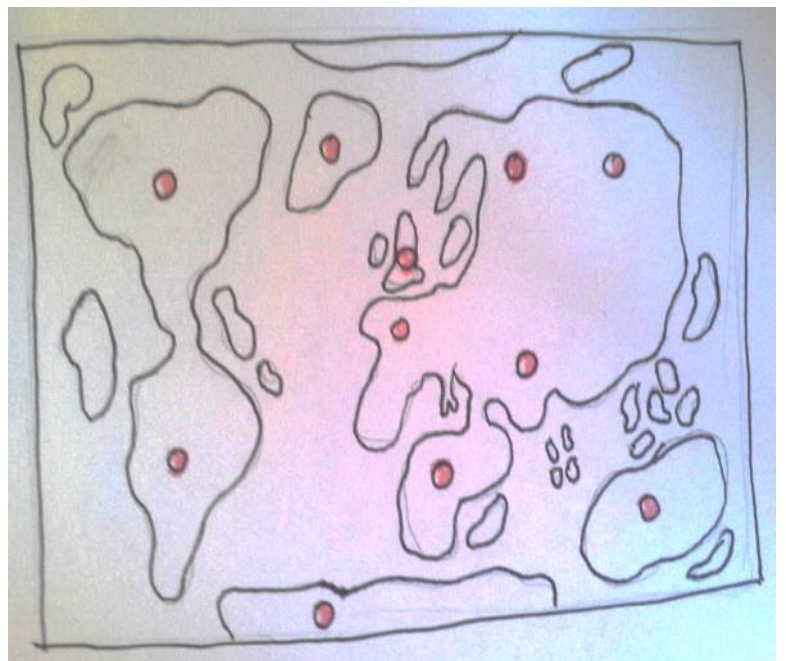
The map while a simple design offers me the change of developing my Arduino skills using a simple touch sensor. As well a simple touch sensor just using foil for example will keep the project quite cheap.



The image to the left shows my second concept for the interactive map which at first would have a separate board containing the touch sensor. The board I found later on was quite unnecessary and that I could include the touch sensors on the map making the product very compact.



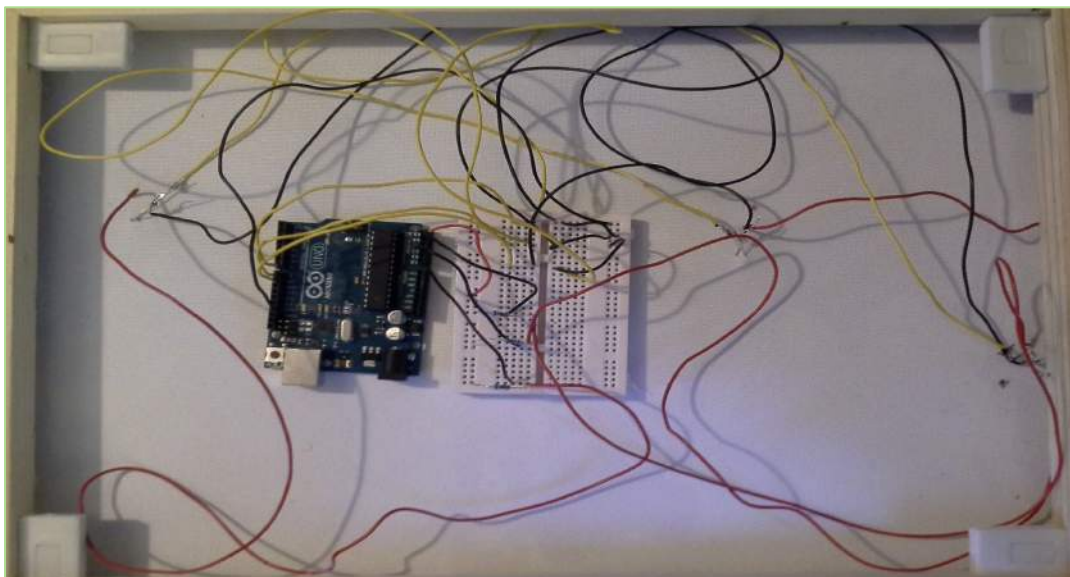
With this product as well I could use either a flat map which the Arduino encased behind or a globe which will keep all the Arduino inside. The sketches below show both concepts.



Arduino

The grid below shows all the Arduino components I used to create the final product and the reason I used each item.

Product	Why I used it and what for
1x Arduino Uno	The Arduino Uno board is the basis for the whole project which attaches to the computer to have programs uploaded to it telling the components what to do.
Red Wire	The wire was used to link all the components together with the Arduino Breadboard and LED's . The end of the wires as well form the basis of the touch sensor. The wires are different colours so that when I was setting them up on the Arduino and Breadboard I could assign them different positions for example the red wires are all the touch sensors.
Yellow Wire	
Black Wire	
5x Red LED's	The LED's went on the canvas map and lit up when the touch sensor was triggered.
5x 10 Ohm Resistors	The resistors are connected to the sensors giving power to the touch sensors. 10 Ohm resistors were used because they were stronger and detected the sensors better.
1x Wave Shield	The waveshield when attached to the Arduino played sound when triggered by the touch sensors.
1x Breadboard	The Breadboard was another area which using wires I could attach to the Arduino and build up many pin area using it.
Arduino Sketch	Arduino sketch I used to program the Arduino Uno by writing the program on the sketch page. The same applies to the Processing sketch which I used later on to help play the music for the map.
Processing Sketch	



The image on the left shows the final product open at the back with 3 of the 5 sensors set up on the Arduino and breadboard.

Construction

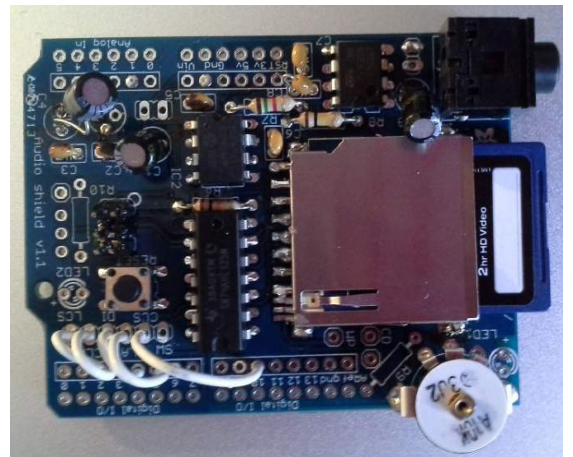
For the final product I decided on using a canvas map to create my interactive music map. This gave me space at the back of the canvas to put the Arduino and wires keeping the product very compact.



The image to the left shows a canvas map this is not the exact canvas map I used for the final project but depicts how the map looks with a plain background and outline of continents.

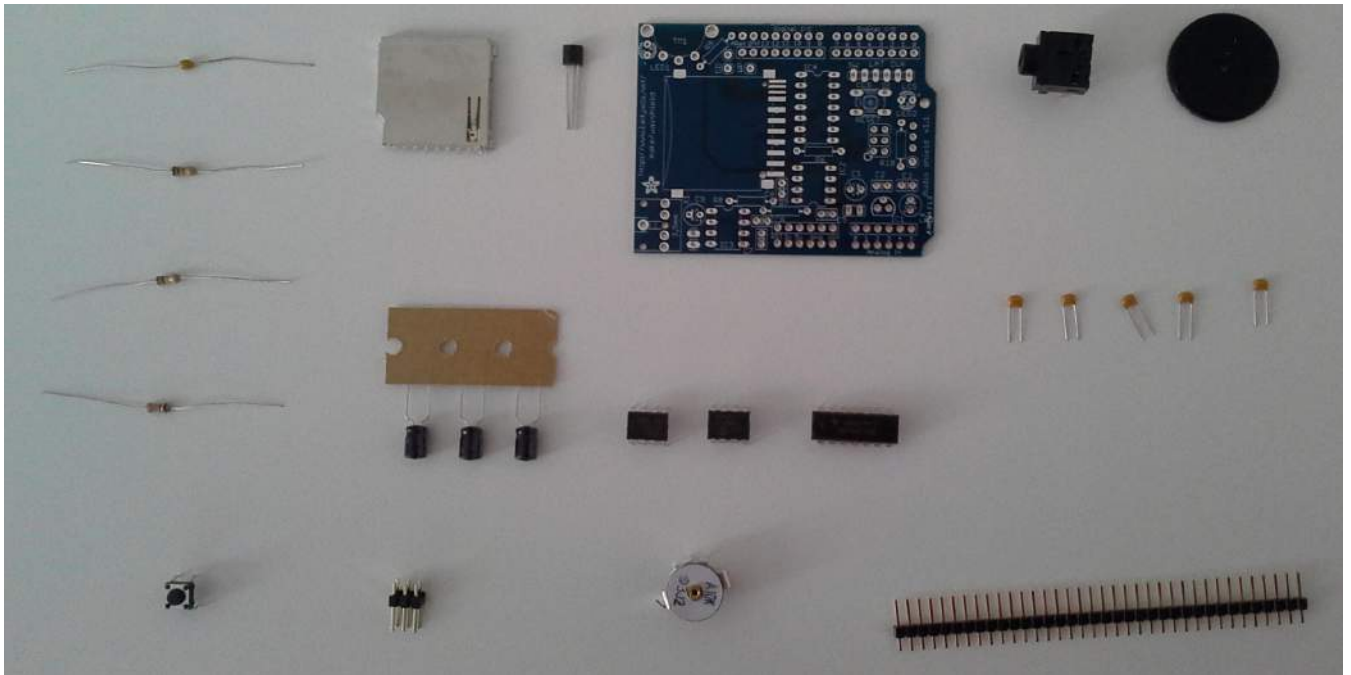
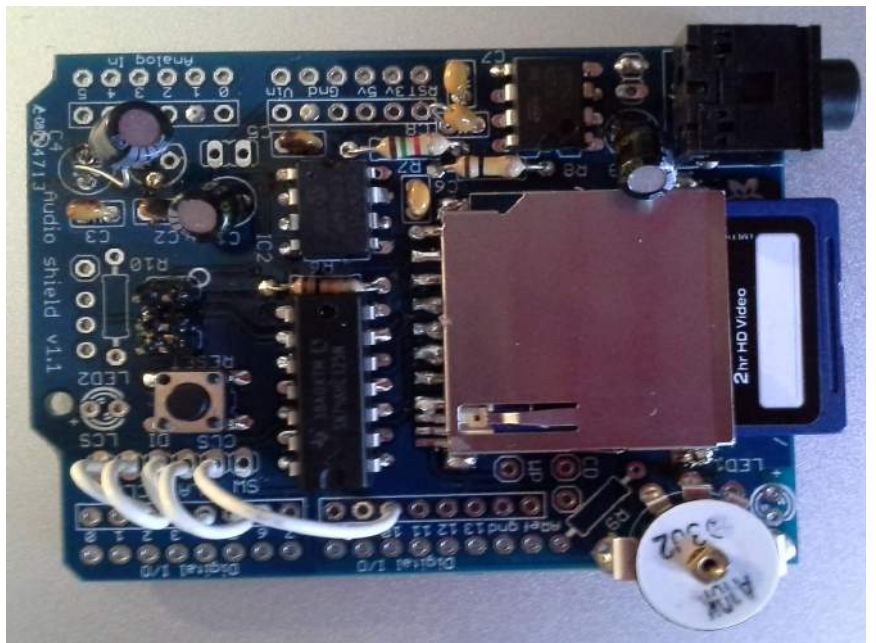
The image below to the left is of copper foil sheets. The touch sensor while at the end of the wires is a small area to increase the area to more of the button I attached copper foil to the end and then stuck the foil to the front of the map.

The final image shown below is of the waveshield which I created out of a kit unfortunately because of soldering problems the waveshield did not work meaning I had to turn to the processing program to play the music out of my computer. As well the waveshield coming as a kit was an added challenge I did not anticipate.



Construction

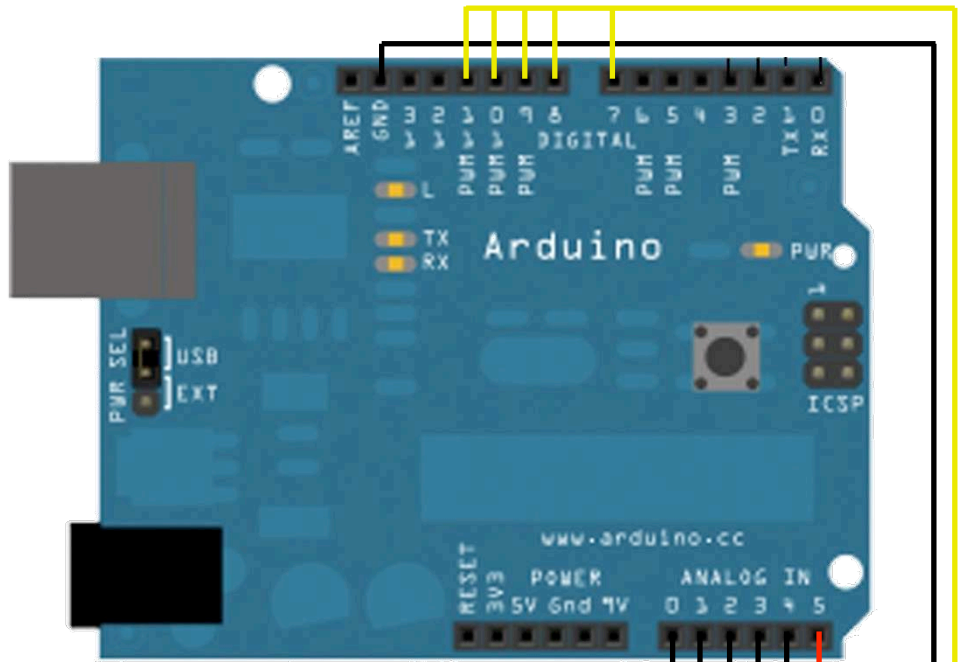
Because of technical difficulties with y waveshield I had to use the processing program instead to create the music effect on my interactive map.




When I received the waveshield it was in the form of a kit which included all the parts I needed to put it together minus a small bit of wire. The kit was a challenge because while I had soldered before my skills were very rusty so it took me some time to put together. As well because of mistakes I made the waveshield could not function properly afterwards. If I was to use the waveshield again I would get the same kit but take more time over constructing the shield and also get more help. The parts that the kit included are...

- 3.3v linear voltage regulator
- 12-bit DAC
- High current opamp
- Level shifter for SD card
- SD/MMC card holder
- 10k or 50k audio thumbwheel pontentimeter
- Stereo headphone jack
- 1.5k resistor
- 10k resistor
- 100k resistor
- 0.01uF ceramic capacitor
- 0.1uF ceramic capacitor x5
- 6v or greater capacitors x3
- 6mm tactile switch
- 6 pin ICSP header
- 36 pin male header
- Circuit board

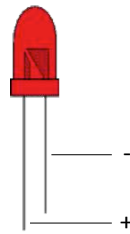
Construction



Key

 = 10 Ohm Resistor

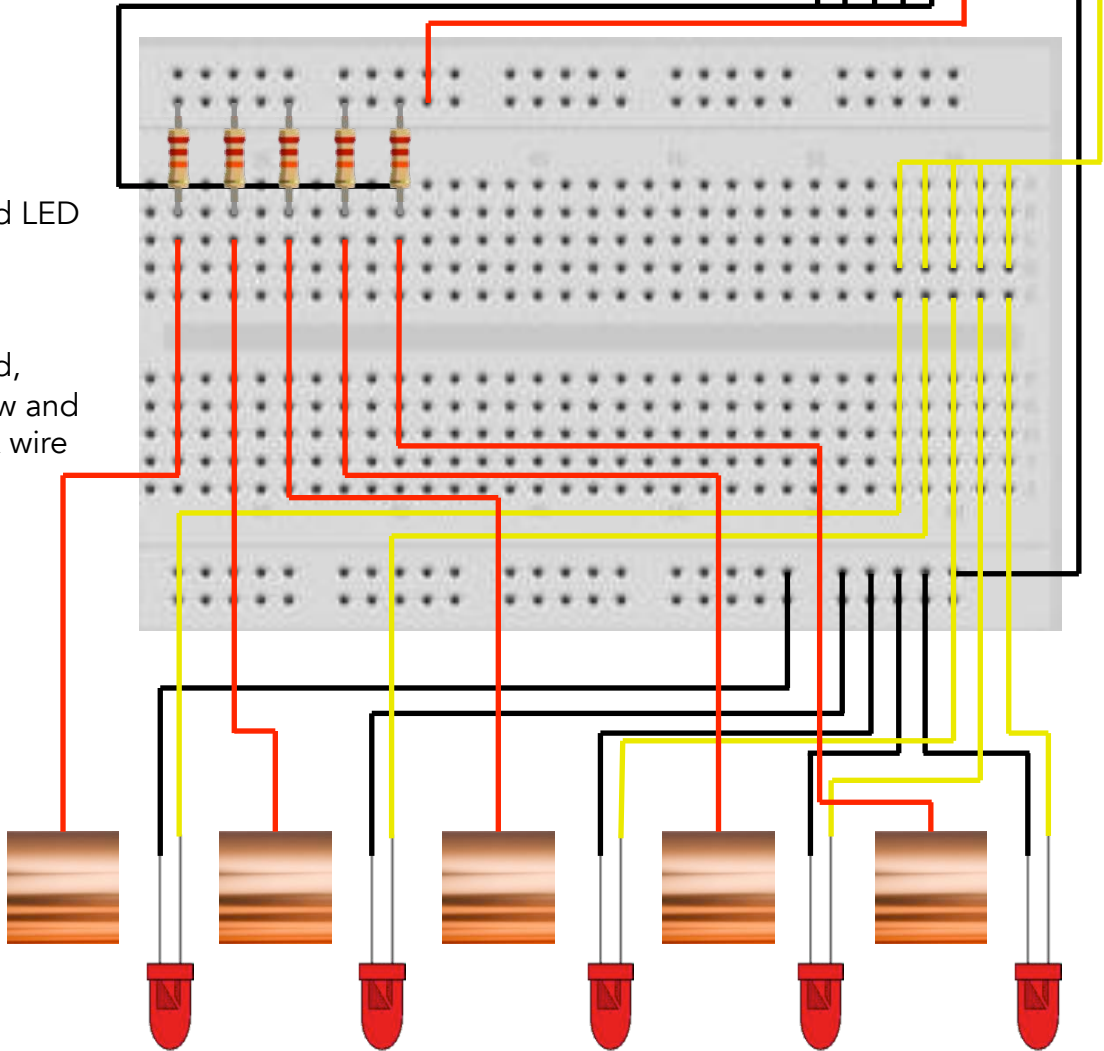
 = Cooper Foil

 = Red LED

 = Red,
 Yellow and
 black wire

The pins used on the Arduino are...

- A0
- A1
- A2
- A3
- A4
- A5
- 7
- 8
- 9
- 10
- 11



Above is a diagram showing how the Arduino Uno and Bread board are linked up with wires and connected to the LED's and cooper wire. A key is also shown on the left hand side.

Construction

Using Arduino sketch I was able to program the Uno to get the pins working correctly and to make sure the right sensors were linked to the right LED's. the program is shown below in dark green font with an explanation of certain sections on the right hand side. Some sections may be circled with boxes to highlight them more.

```
CapacitiveSensorDue Africa = CapacitiveSensorDue(A5,A4);  
CapacitiveSensorDue Asia = CapacitiveSensorDue(A5,A2);  
CapacitiveSensorDue America = CapacitiveSensorDue(A5,A0);  
CapacitiveSensorDue Russia = CapacitiveSensorDue(A5,A3);  
CapacitiveSensorDue Australia = CapacitiveSensorDue(A5,A1);
```

This is the initial set up of the pins for the capacitive sensor. This also gave me a chance to name each sensor so it was easier for me later on.

```
void setup()  
{  
  
    Serial.begin(9600);  
  
    pinMode(7, OUTPUT);  
    pinMode(8, OUTPUT);  
    pinMode(9, OUTPUT);  
    pinMode(10, OUTPUT);  
    pinMode(11, OUTPUT);  
  
    pinMode(A0, OUTPUT);  
    digitalWrite(A0, HIGH);  
  
    pinMode(A1, OUTPUT);  
    digitalWrite(A1, HIGH);  
  
    pinMode(A2, OUTPUT);  
    digitalWrite(A2, HIGH);  
  
    pinMode(A3, OUTPUT);  
    digitalWrite(A3, HIGH);  
  
    pinMode(A4, OUTPUT);  
    digitalWrite(A4, HIGH);  
  
    pinMode(A5, OUTPUT);  
    digitalWrite(A5, HIGH);  
  
    Serial.println('A');  
    Serial.println('a');  
  
    Serial.println('B');  
    Serial.println('b');
```

This section is called the void setup what it does is it activates the pins I indicate I want. For example for pin A2 I have indicated it to be an output and on a digitalWrite to be on High.

The serial print in part of the program refers to the collaboration with the processing sketch with indicating the serial print for each file with for example 'A' being turn on file and 'a' being pause file.

Construction

Using Arduino sketch I was able to program the Uno to get the pins working correctly and to make sure the right sensors were linked to the right LED's. the program is shown below in dark green font with an explanation of certain sections on the right hand side. Some sections may be circled with boxes to highlight them more.

```
Serial.println('C');  
Serial.println('c');  
  
Serial.println('D');  
Serial.println('d');  
  
Serial.println('E');  
Serial.println('e ');  
}
```

```
void loop()  
{  
    long start = millis();  
    delay(100);  
  
    long total1 = Africa.read(30);  
    delay(100);  
  
    long total2 = Asia.read(30);  
    delay(100);  
  
    long total3 = America.read(30);  
    delay(100);  
  
    long total4 = Russia.read(30);  
    delay(100);  
  
    long total5 = Australia.read(30);  
  
    if (total1>1000) {  
        digitalWrite(7, HIGH);  
        Serial.println('A');  
    }  
    else {  
        digitalWrite(7, LOW);  
        Serial.println('a');  
    }  
}
```

This final section of the program on Arduino is the main point telling the arduino what to do with each pin. There are 5 sections all the same except for different pin and total numbers. Essentially what it is telling the arduino is that if the capative sensor total 1 for example is reading 1000 pin 7 should turn on turning on the LED as well as turning on 'A' which turns on the music. Then if the sensor is not 100 pin 7 turns off and "a" shows again pausing the music.

The long start points at the beginning are assigning the capative sensor to each total (e.g. total 2 = Asia

```
        if (total2>1000) {  
            digitalWrite(8, HIGH);  
            Serial.println('B');  
        }  
        else {  
            digitalWrite(8, LOW);  
            Serial.println('b');  
        }  
  
        if (total3>1000) {  
            digitalWrite(9, HIGH);  
            Serial.println('C');  
        }  
        else {  
            digitalWrite(9, LOW);  
            Serial.println('c');  
        }  
  
        if (total4>1000) {  
            digitalWrite(10, HIGH);  
            Serial.println('D');  
        }  
        else {  
            digitalWrite(10, LOW);  
            Serial.println('d');  
        }  
  
        if (total5>1000) {  
            digitalWrite(11, HIGH);  
            Serial.println('E');  
        }  
        else {  
            digitalWrite(11, LOW);  
            Serial.println('e');  
        }  
    }  
    delay(100)
```

Construction

With my waveshield broken I had to turn to an alternative system to play my sound. What I used is Processing which was very much like Arduino and they worked together very well.

The image to the right is a screenshot of the editing of each music piece I did in Adobe Audition to get the track down to 30 seconds each.



```
import processing.serial.*;
import ddf.minim.*;
```

```
Minim minim;
Serial port;
String val;
AudioPlayer playerA, playerB, playerC, playerD,
playerE;
```

```
// Setup
void setup() {
```

```
  // we pass this to Minim so that it can load files
  from the data directory
  minim = new Minim(this);
```

```
  // Load in the video
```

```
  playerA = minim.loadFile("Africa.mp3");
  playerB = minim.loadFile("Asia.mp3");
  playerC = minim.loadFile("America.mp3");
  playerD = minim.loadFile("Russia.mp3");
  playerE = minim.loadFile("Australia.mp3");
```

```
  // Open the serial port
  port = new Serial(this, "/dev/cu.usbmodem1421",
9600);
  // port = new Serial(this, "COM30", 9600);
```

```
}
```

```
void draw() {
  background(0);    // Paint the background block
  stroke(255);      // Set the drawing colour
```

```
  // Read the string value from the Arduino if it has
  sent something
  if ( port.available() > 0 ) {
    val = trim(port.readString());
```

```
  // Compare the string against the known commands
  // First commands to start play
  if (val.equals("A") && !playerA.isPlaying()) {
    playerA.play();
  }
  else if (val.equals("B") && !playerB.isPlaying()) {
    playerB.play();
  }
  else if (val.equals("C") && !playerC.isPlaying()) {
    playerC.play();
  }
  else if (val.equals("D") && !playerD.isPlaying()) {
    playerD.play();
  }
  else if (val.equals("E") && !playerE.isPlaying()) {
    playerE.play();
  }
  // Next commands to stop play
  else if (val.equals("a")) {
    playerA.pause();
  }
  else if (val.equals("b")) {
    playerB.pause();
  }
  else if (val.equals("c")) {
    playerC.pause();
  }
  else if (val.equals("d")) {
    playerD.pause();
  }
  else if (val.equals("e")) {
    playerE.pause();
  }
}
```

The highlighted section above is the main section I edited after Alistair helped me with this program. What I mainly did was add two more players and put in the file names after I copied the files into the processing file.

Branding

After creating the final product I started thinking about the branding for the product. I decided that the map would be a tool used in classrooms and museums teaching children about the different styles of music around the world whether in separate countries or continents.

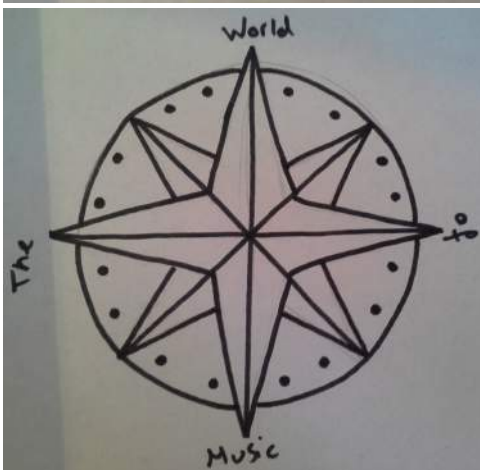
The style I decided on was hand drawn. As well the image would be the main part of the logo which could be used separately and recognized.



The first image I created was using a globe this was a very simple design which would then have the name of my product World of Music around the globe. This hand drawn style is good as well because it is recognizable as the world but also is bold in a black outline.



The image to the right is an example of images I referred to to draw the image on the left.



When I started thinking about images relating to the world another sprung to mind in the form of a compass. This compass would be a very simple design using a bold black outline. The name of my product would then go around the compass where North, East, South and West are usually indicated.



The image to the right is the image I used to draw the compass image on the left which is nearly identical.



The last image I created for the branding played on the idea of nostalgia. It did this by having an old scroll map as the logo image for a new innovative map. The scroll map would be simply the map with the name of the product World of Music in the bottom right corner.



The image to the right is an example of a scroll map style I could use. The old paper style is a style I could also adopt for the logo.

<http://www.vectortemplates.com/raster/globes-021.png>

http://www.thewriterscompass.com/wp-content/uploads/2011/06/Antique-Compass-1103474_55801016.jpg 17

<http://www.backgroundsy.com/file/large/scroll-world-map.jpg>

Branding



The final design I have decided on is using the globe. To create the final design I scanned the image I drew and used Photoshop to trace around the image to create a bold black outline. With the black outline I then coloured the globe in using a scribble style in bold colours. With the globe the name of my product would be in red in a nostalgia style font. The type of fonts that I looked at was Apple Chancery, American Typewriter and Brush Script.

World of Music World of Music World of Music

After experimenting with the font styles and the alignment of the text next to the globe I decided on having the text on the left with the globe on the right. As well the globe can be used by itself to depict the product and its name as a recognizable image. For this project the branding is mainly used on the final product video which I have created.

World of Music

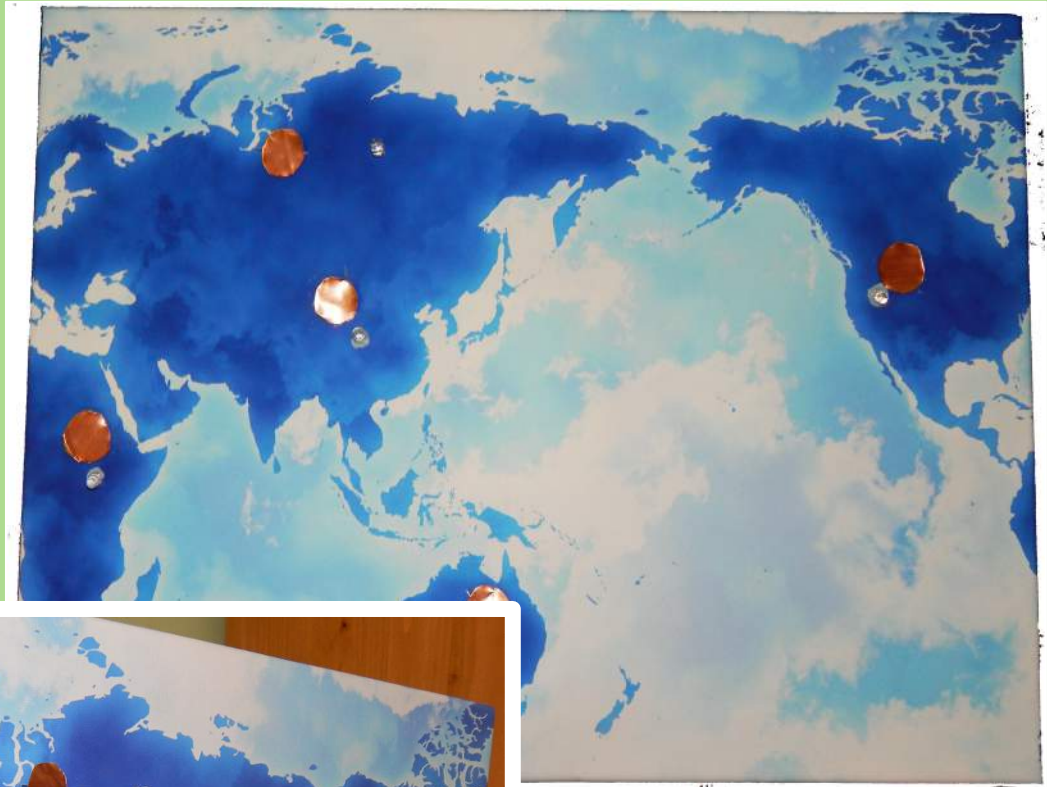


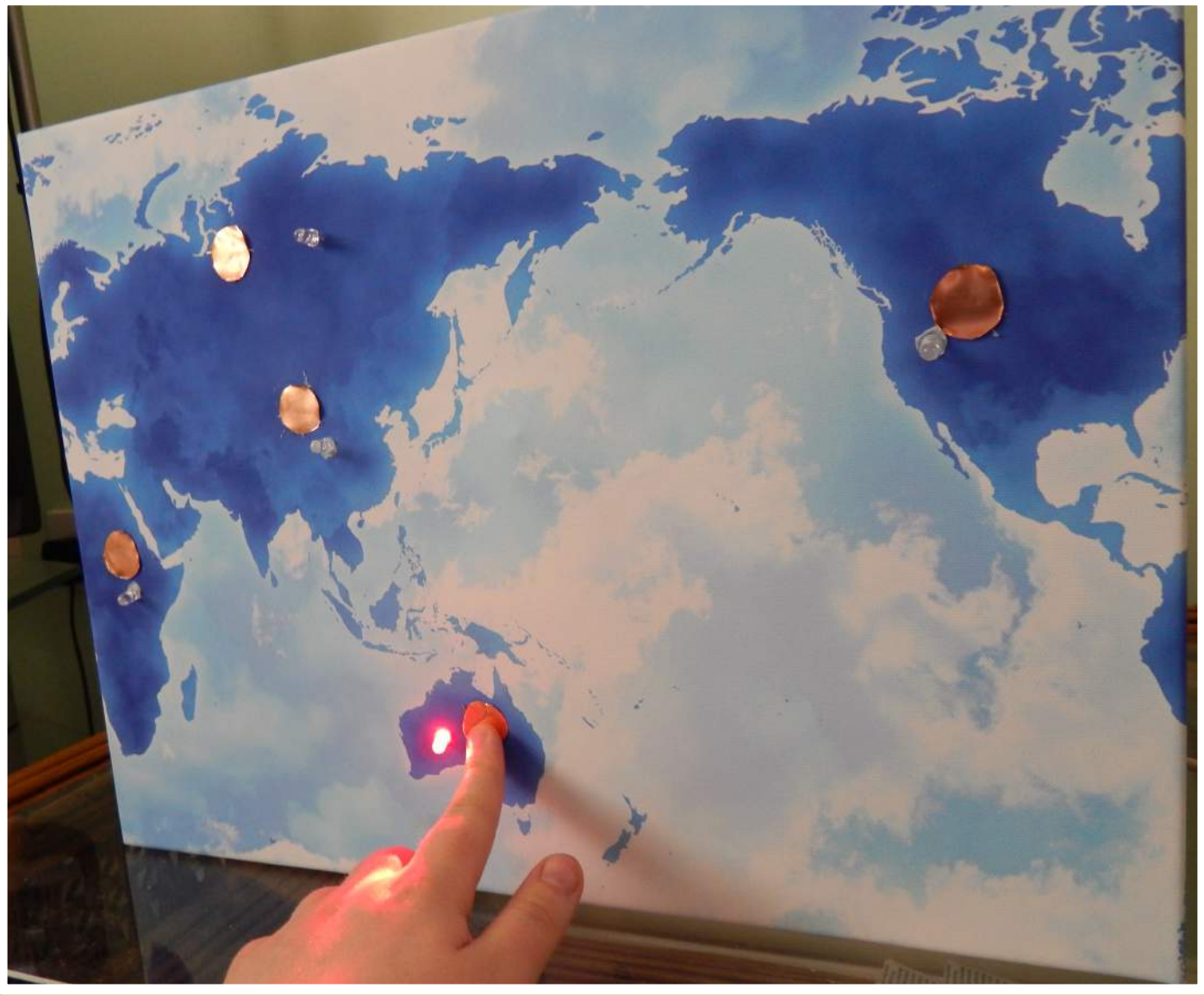
Final Product

Below is a link to the YouTube page showing my final video presentation of my World of Music.

https://www.youtube.com/watch?v=eY5mz-N_mZI&feature=youtu.be

The images on the next few pages are a collection of the final product ...





Conclusion

This project has been a great new challenge for me with the new technology of Arduino. Despite this challenge I have enjoyed this project a lot with a much more open brief I was able to create something more for me which appeals to my tastes. As well the Arduino work has been very interesting and fun to learn about with all the possibilities that I had for the project.

If I was to do this project again I believe I would try stretch myself more with using Arduino and also try come up with a more original idea. As well this project has given me a chance to practice my practical skills which I hope to improve even more to make my next product even better. This project for me overall has been a success with a very different approach compared to other projects I have done in the past. In the future I would definitely use Arduino again for a project to challenge myself and broaden my knowledge on electronics.



Bibliography

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- <http://achuwilson.wordpress.com/2011/12/15/arduino-ide-for-programming-atmega-microcontrollers/> (Content page Arduino board image)
- <http://www.instructables.com/id/The-Word-Clock-Arduino-version/> (Brief Page Arduino clock)
- <http://edition.cnn.com/2012/04/20/world/europe/buckingham-palace-art-projection/> (Buckingham Palace Projection)
- <http://www.instructables.com/id/Arduino-Projects/> (Used to research all the Arduino projects for the research pages)
- <http://www.instructables.com/id/Magic-Light-Capacitance-Sensor-first-ardino-proj/> (Research page magic light)
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- <http://www.vectortemplates.com/raster/globes-021.png> (Globe image on branding page)
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- <http://www.learningaboutelectronics.com/images/Arduino-motion-sensor-circuit.png> (First concepts page PIR sensor image)
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