Making a Singing Glowing Pumpkin

Is it nearly Halloween? Got a carved pumpkin that's just a bit too standard and boring?

Do something amazing and unusual with it! Make it into a Singing Glowing Pumpkin that springs into action whenever anyone walks by.

A shrimp is a small computer made by you from individual components. It can do all sort of things, and is similar to an Arduino or Rasberry Pi but a lot cheaper.

This kit contains a motion sensor that detects movement around it and makes stuff happen. You could also use it to bring other models to life such as a Lego building.

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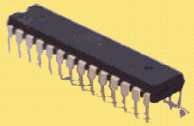
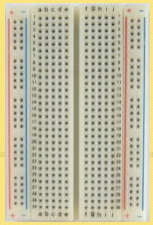
What you'll need to start your Singing Glowing Pumpkin

These are the basic building blocks for our Pumpkin kit to make our mini computer. We'll tell you about each of these in turn in the next pages.

The Shrimp



ATMEGA328 microcontroller



400 point solderless breadboard

The Breadboard

This is a simple way of connecting wires without needing to solder. It has metal grippers inside which join the holes along each row. To use it simply slide in your wires straight and firmly. Each hole has a grid reference: letters along the top, numbers along the side, and we'll be using these to help you place components correctly.

10 kiloOhm resistor Brown, black, orange stripes

100 nanoFarad ceramic capacitor It should say 104

16 MHz Crystal

4 LEDs

9 pin header strip

5V PIR sensor

A piezo buzzer

Lots of wires

USB to UART CP2102 module

PIR sensor
A passive infrared sensor measures infrared light radiating from objects in its field of view.

You will also need a computer with the free Arduino software installed.
See www.arduino.cc

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Step 1a – Get your computer ready!

The Arduino Environment

The brains of your Pumpkin is the ATMEGA328 microcontroller or chip. It is ready waiting to do whatever you tell it, but you must program it. This is done by uploading code to it through any computer.

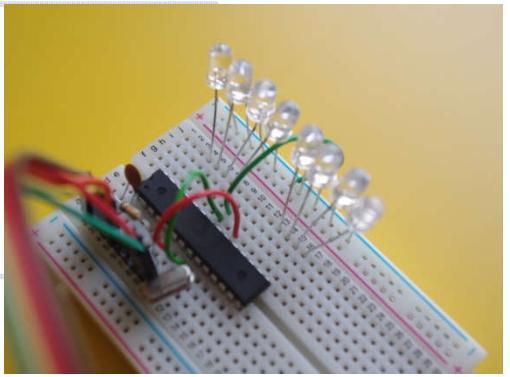
The shrimp you will make is compatible with an Arduino Uno that you can buy as a kit for a lot more money. The Arduino environment is used to tell your computer what to do.

You will need to install the Arduino IDE to write and upload new programs to your Shrimp. It is free and you can download it from :

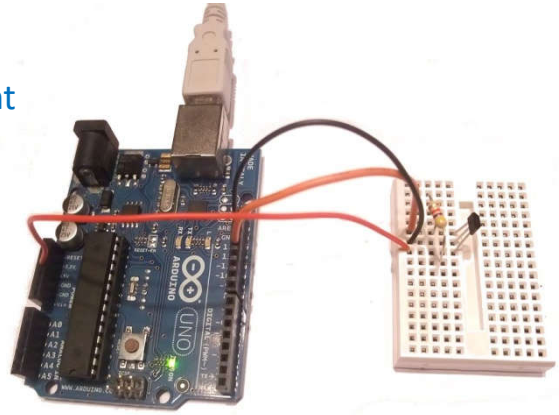
http://arduino.cc/en/main/software

You need the Arduino IDE 1.0.6 – download and install it for whichever system you are using.

A shrimp Arduino compatible circuit.



The shop-bought Arduino Uno.



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Step 1b – Get your computer ready!

Communicating with the shrimp

To upload a new program to the shrimp you need to have drivers installed on your computer to tell it how to use the USB module.

You can download the CP2102 drivers for Windows and Mac at:

http://shrimping.it/drivers/cp2102/

While you are there take a quick look around the website to get another look at shrimping.

The Singing Glowing Pumpkin code

Now you need the code to run the pumpkin. Go here:

https://github.com/kirstysparrow/pumpkin

And choose singing_glowing_pumpkin_code.ino

Select it all and copy, and paste it into your arduino software as a new sketch. Save it as Singing glowing pumpkin (or whatever you want to call it!) on your computer.

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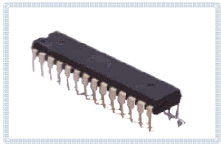
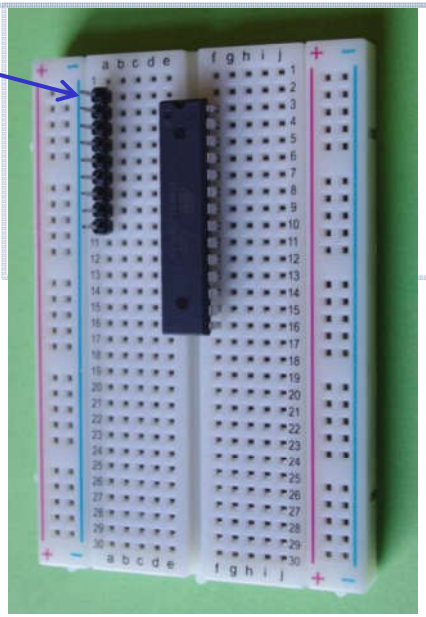
Step 2 – The Chip and connector

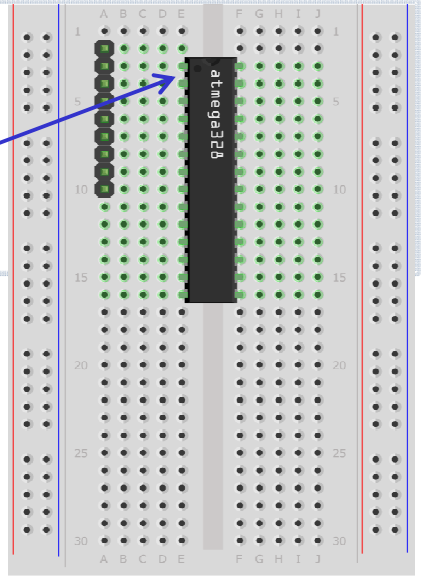
The chip is the brains of the computer, the same as in any computer.



Top in A2



Top left in E3



The connector is a simple way of attaching the wires which will let us program our computer.

1. Insert the chip into the board. Look carefully to make sure it is the correct way up. The little semi-circular hole should be at the top. Once you get the pins in the holes, place a finger on each end and firmly press it down till it sits touching the bread board.
2. Insert the connector into the board. You'll also need a firm push with this one.

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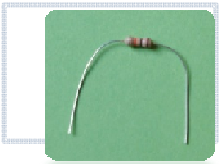
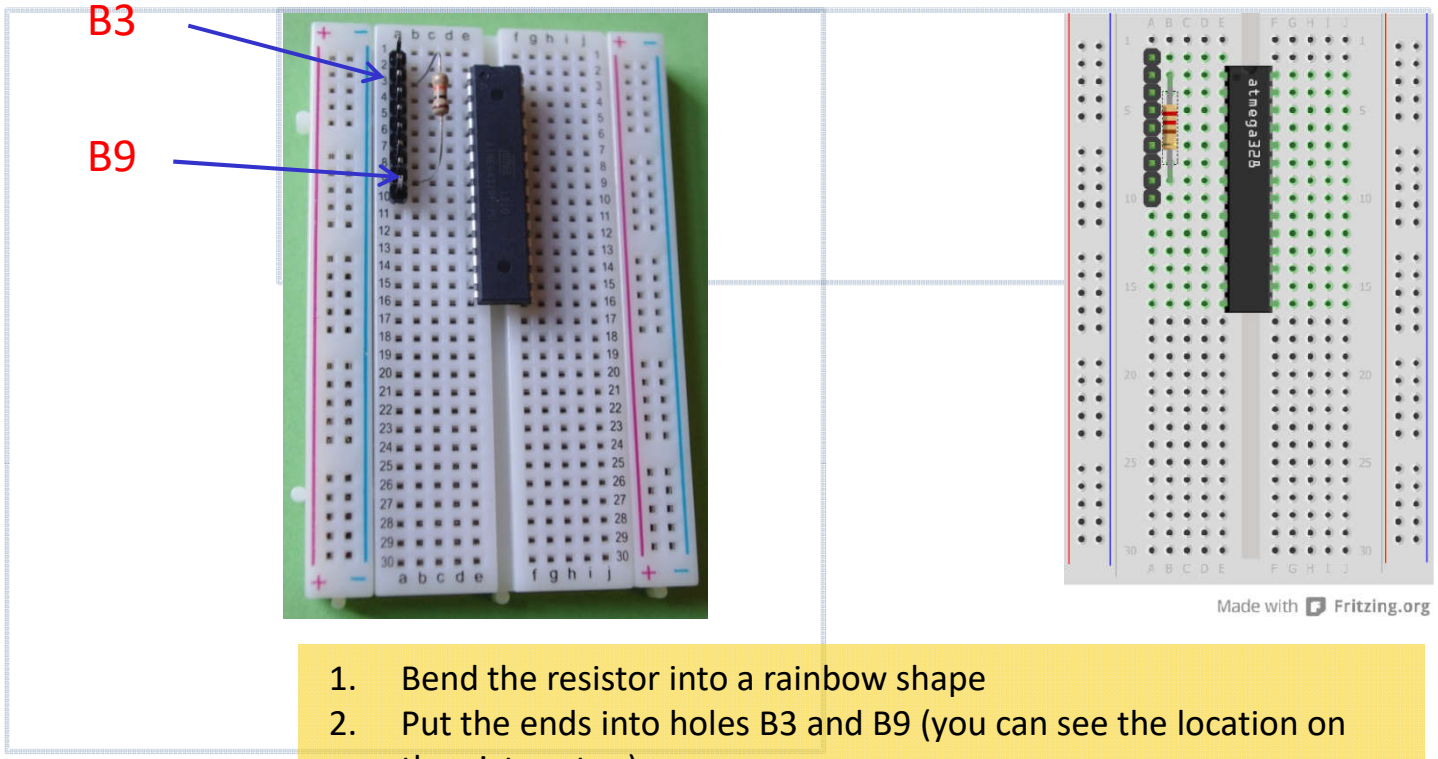
Step 3 – Adding a resistor





1. Bend the resistor into a rainbow shape
2. Put the ends into holes B3 and B9 (you can see the location on the picture too)

The resistor does what it says, it is a material that resists (or stops) current (electricity). This means it just lets a little bit through so that the components are not damaged by too much power.

You can see that this will connect two pins of the chip together, to begin to form a circuit

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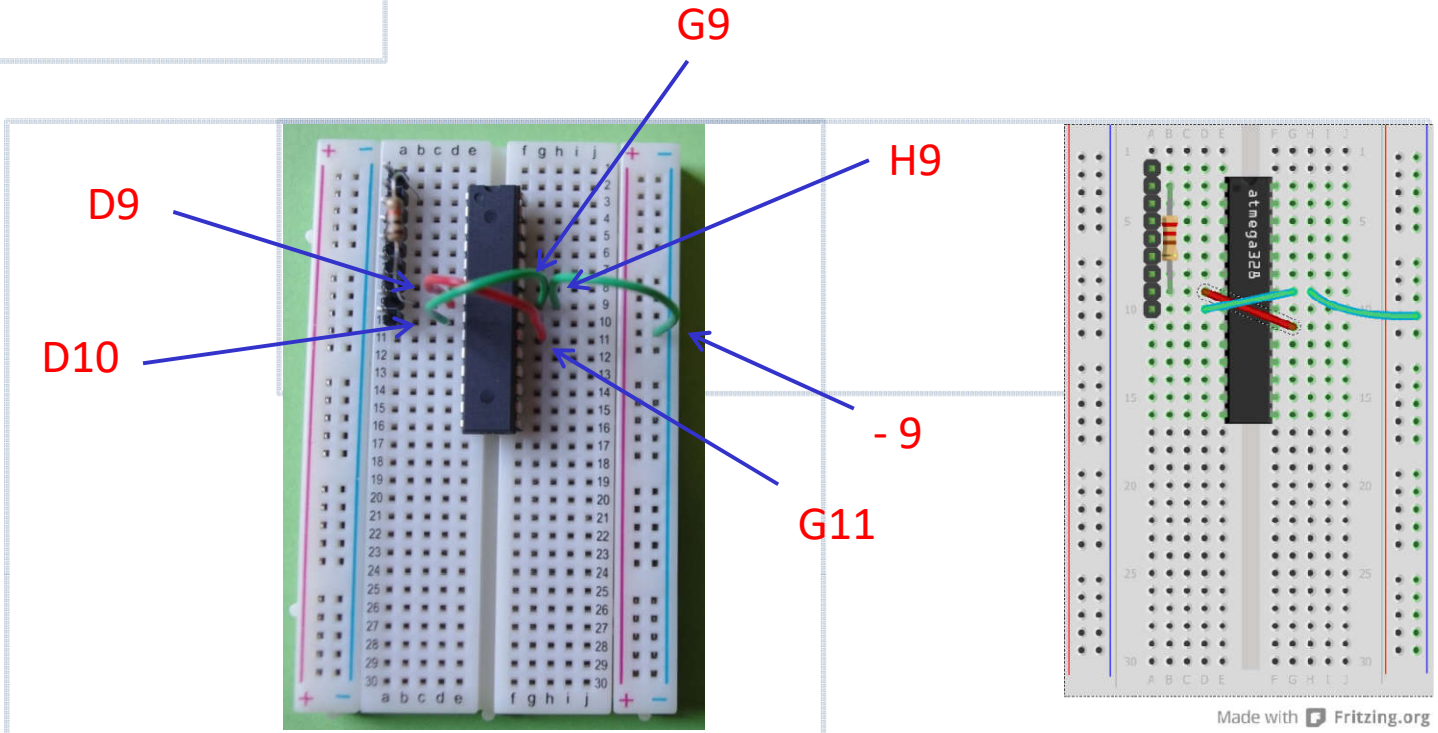
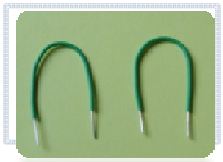
Step 4 – adding wires!





Top tip:
Wire colours don't really matter, but are just to make life easier for you as you follow the instructions!

1. Bend the wires into rainbow shapes.
2. Put the red wire in D9 – G11
3. Put the first green wire in D10 – G9
4. Put the second green wire H9 – (negative rail (9th hole)

The negative rail is the vertical column on the right hand side of the board that is labelled - . Ground is the return path for a circuit. When the LED has been lit the current (electricity) needs to get back to the power supply so that it can start the loop again. A more powerful circuit actually connects to the "ground" (the one you are standing on) as this makes sure you do not get an electric shock.

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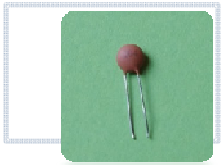
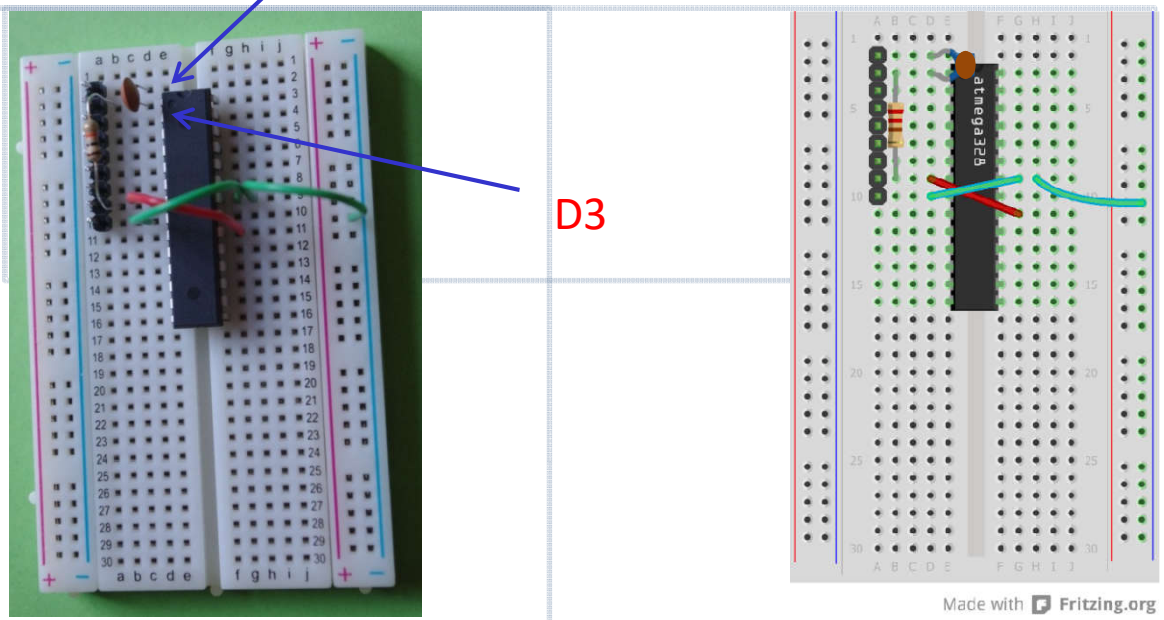
Step 5 – Adding a capacitor





1. Find the capacitor labelled 104 on the side
2. Put the capacitor in D2 and D3

The capacitor is a little like a battery. It takes energy from the battery and then releases the energy very quickly. It keeps the power level consistent.

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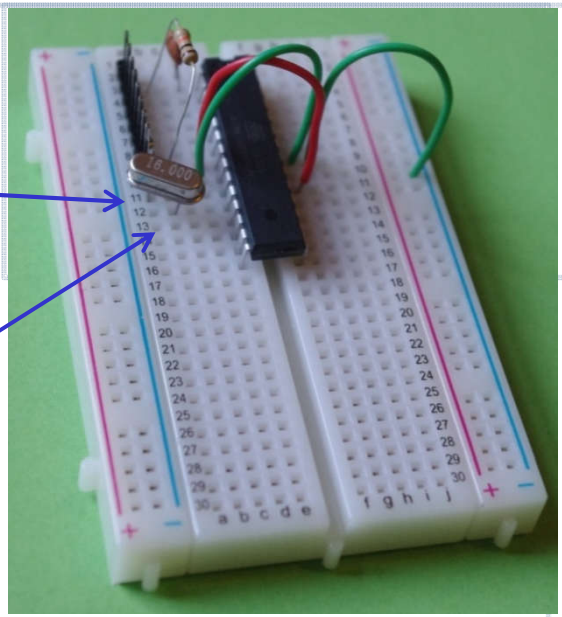
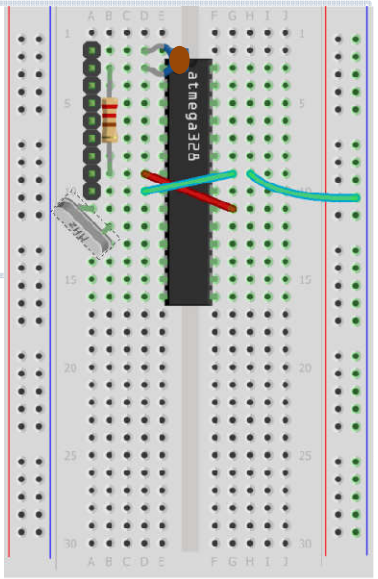
Step 6 – The Quartz Crystal

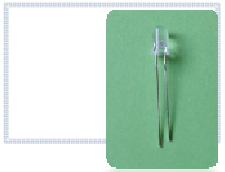


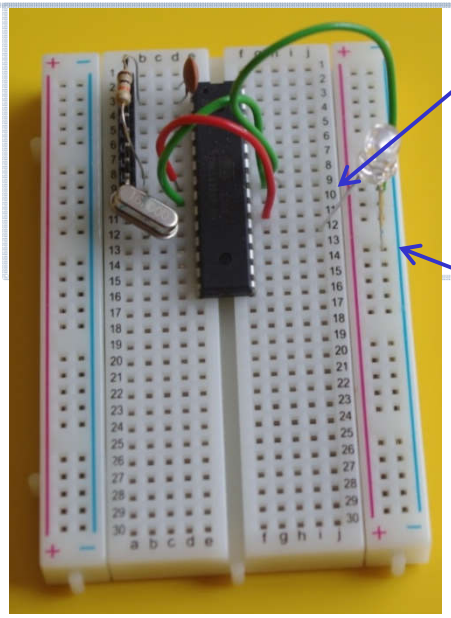


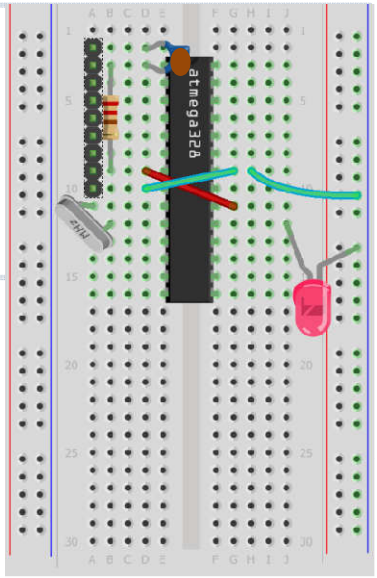
1. Put the crystal in A11 and B12

The quartz crystal is like a clock, providing a pulse that makes the chip function (on-off-on-off).

Step 7 – Blink – adding an LED







1. Look at the LED, and notice that one leg is longer than the other. LED's only work in one direction.
2. Insert the long leg into J12 where it connects to the pin of the chip.
3. The short leg goes in the top hole on the third group of holes on the rail (the negative rail) or hole 11.

A diode is a one way gate for electricity. A light-emitting diode (LED) glows when electricity passes through it. Most LEDs are made from a semi-conducting material called gallium arsenide phosphide.

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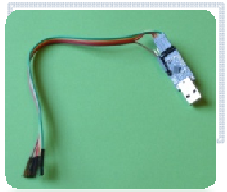
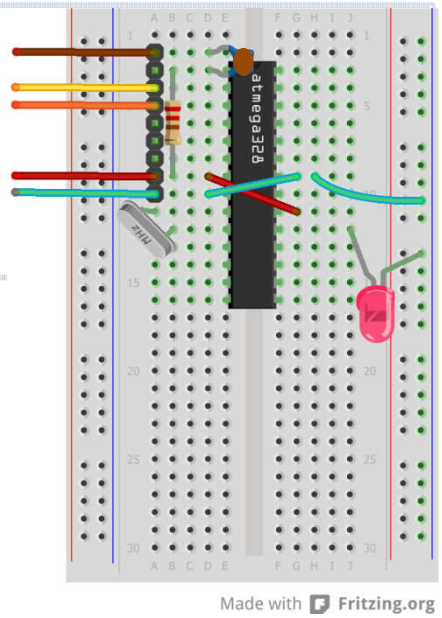
Step 8 – Wiring up the USB connector





You'll need to wire up the USB connector on both ends. Start with the connector piece itself, and wire as shown in the picture. The colours from the left are brown, red, orange, yellow and green. The brown goes on the single pin halfway down the connector.

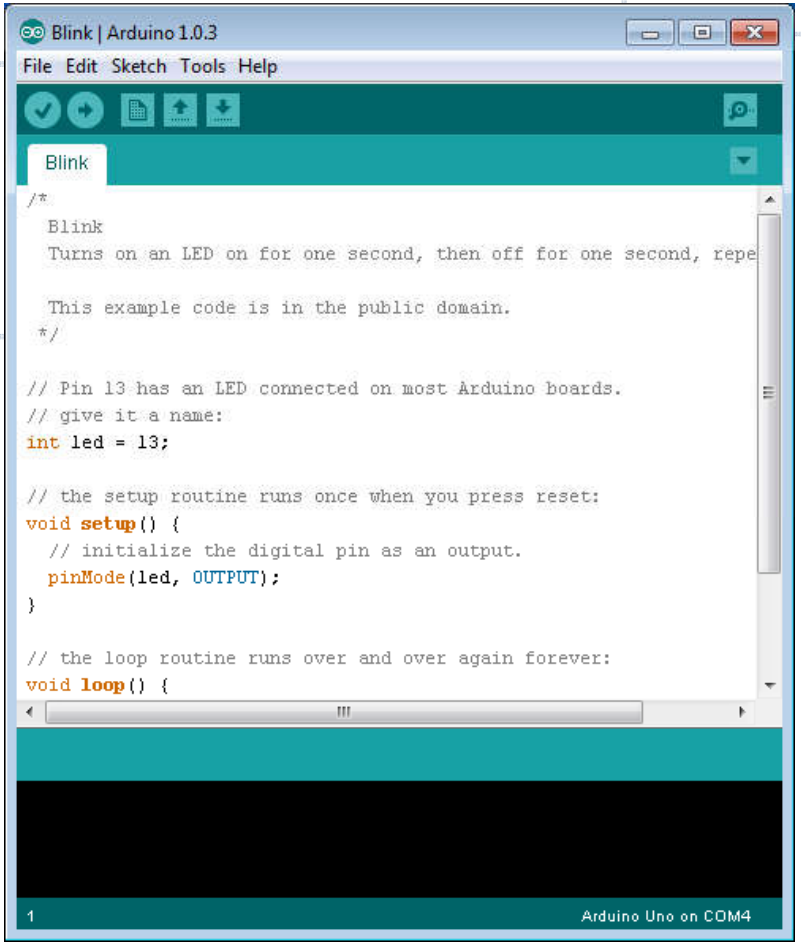
On the breadboard end:

Brown – PIN A2	Yellow – PIN A4	Orange – PIN A5
Red– PIN A9	Green – PIN A10	

Step 9 – Uploading the code – let's test it!

Plug the USB into your computer or laptop.

1. Open up the Arduino Software
2. Under tools choose
3. File -> Examples -> Basic –> Blink
4. Click the upload icon (underneath "edit", the arrow in a circle)
5. If it works the LED will BLINK – Hooray!



Nothing happened!
It's easy to have overlooked something. Don't worry, we can fix it.

1. Check the LED is the right way round.
2. Check all pieces are pushed into the breadboard firmly.
3. Check that all of the pieces are in the right places, and pushed straight down
4. Check under "Tools, Board" to see the shrimp is identified as 'Arduino Uno'.
5. Check under "Tools, Port". You need to chose the correct one, mine is COM3.

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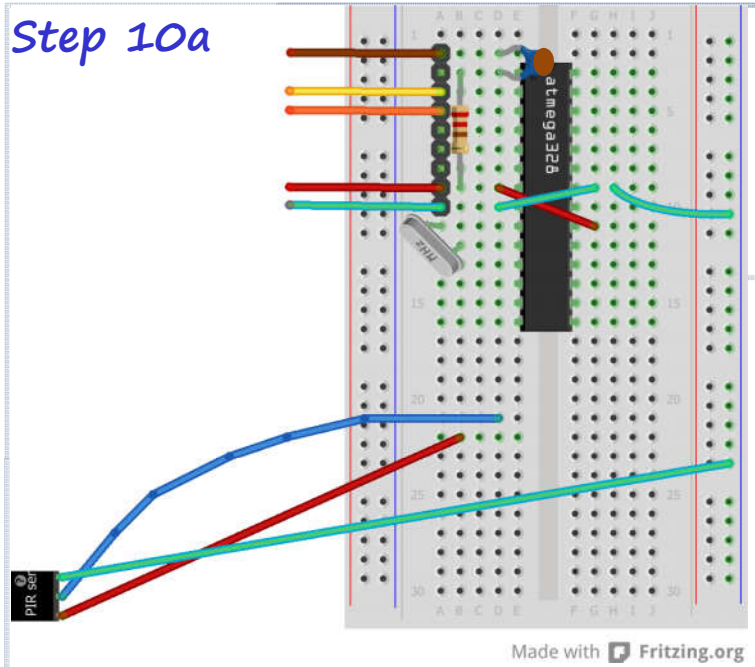
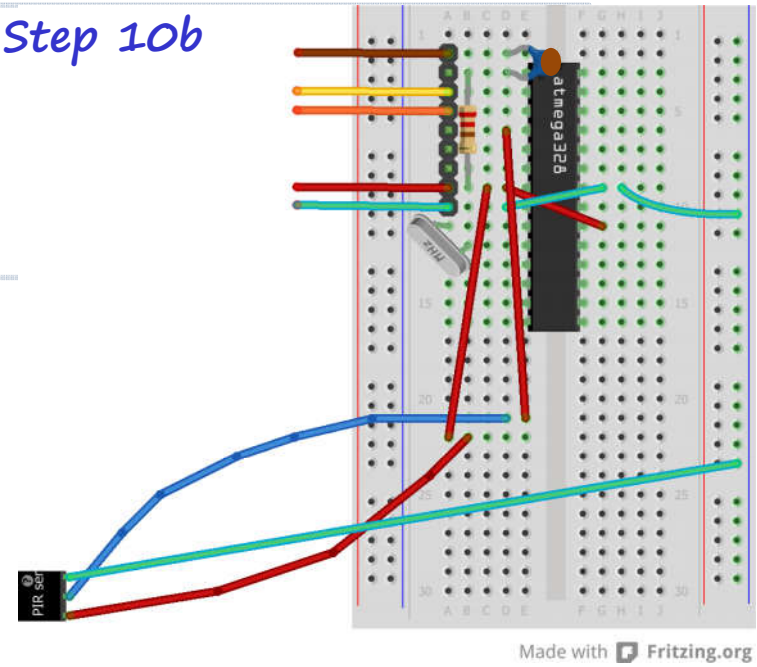
Step 10 – attaching the PIR sensor!

Remove the test LED!

Step 10a



Step 10b



We need to wire up the sensor. This will detect movement and sound the alarm. Look at the pins on the sensor and connect as follows:

Sensor		Breadboard
GND (ground)	to	-20 (negative rail)
OUT	to	D21
+5V	to	B22

Now connect the sensor to our circuit:

Run a wire from A22 to C9 (to power the sensor)
Run a wire from E21 to D6 (to connect it to the chip)

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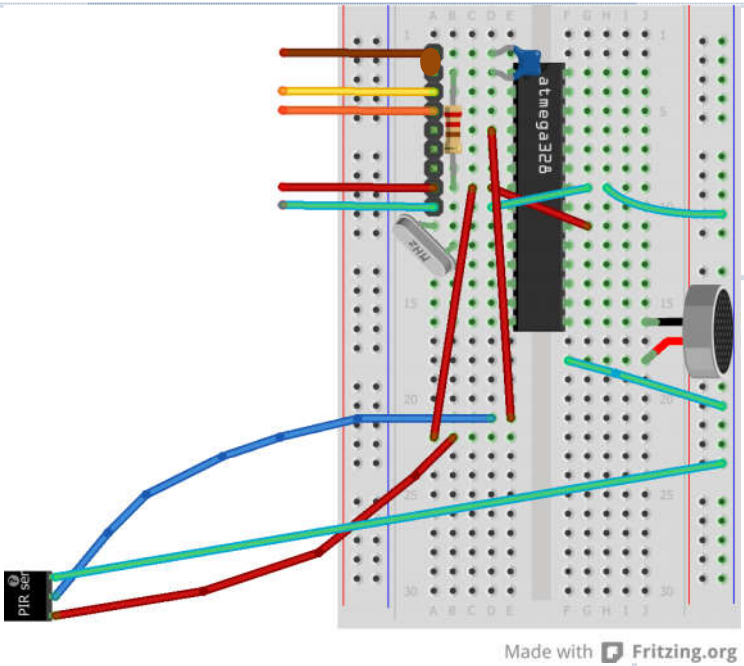
Step 11 – attaching the buzzer!

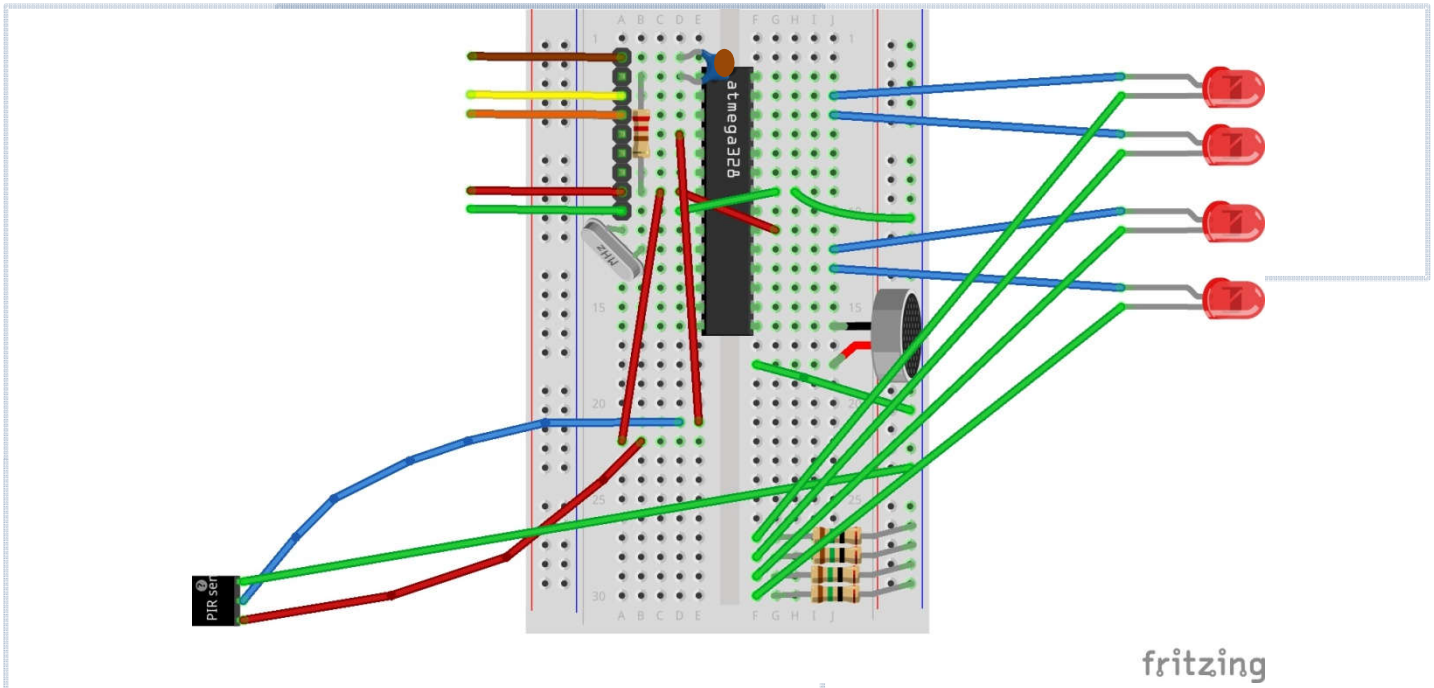


Connect the buzzer by pushing it's legs gently into J16 and J18.

We need to ground it by putting one more wire from F18 to -17 (negative rail 17).

The piezo buzzer makes a noise by vibrating. It can be told to play different notes by vibrating at different speeds.

Step 12 – attaching the lights!



Almost finished – just the lights now!
We need these to be on wires away from the breadboard. Use the male to female wires.

Put the LEDs into:	Put resistors into:
J4 (long leg) and F27	G27 and N22
J5 (long leg) and F28	G28 and N23
J12 (long leg) and F29	G29 and N24
J13 (long leg) and F30	G30 and N25

It is best to use a resistor to limit the current in the circuit, otherwise the LEDs tend to burn out very quickly. It doesn't matter whether we put them before or after the LED in this case as the current is constant around the whole circuit.

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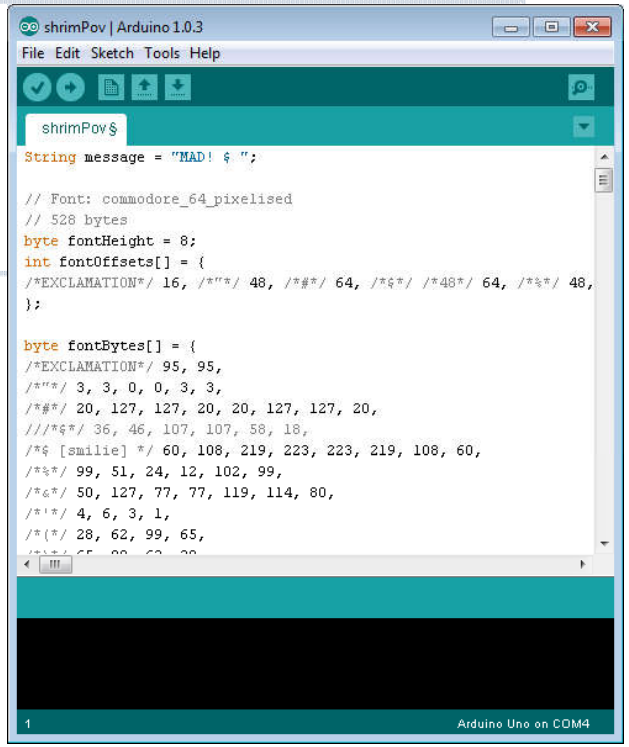
Step 13 – programming the pumpkin!

1. Plug the USB into your computer or laptop.
2. Open up the Arduino Software
3. In the Arduino app load “singing glowing pumpkin” from wherever you saved it.
4. Click the upload icon (the arrow with a circle)
5. If it works the LEDs will flash and the buzzer will sound – Victory !



Last step!

All you need to do now is attach your little computer to the pumpkin shell and personalise it to make it yours.

Top tip: To run the kit from a battery:
Step 1: Turn the battery pack off!
Step 2: Connect the black wire to the negative rail at the side
Step 3: Connect the red wire to J11

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