

# STEMSEL Intermediate Project 2: Olympic Torch Relay

## Problem

We want to make a self-sustaining torch that we can light using an already lit torch.

## Background

The Olympic Games are held every four years and allow the best athletes in the world to compete for medals and fame. You may have seen the Olympic Games on television, or even have been lucky enough to go to see them live, or at least to the torch relay if it passed near where you live. The Olympic torch relay involves carrying the Olympic flame all the way around the world from Olympia in Greece, which was the place of the first Olympic Games, to the current Olympic City, most recently London in England.

The flame is lit by using a mirror to focus the sun's energy, and is then carried around the world by a number of people carrying torches. Each person receives the flame from the previous person, carries it for a certain distance, than passes it on to the next person. Such a process where something is passed on from one thing to another is called a relay, and there is actually a relay race event in the Olympics where teams of runners each take turns carrying a baton around the racetrack. Backup flames are carried in lanterns just in case the torch goes out, and to safely carry the flame on airplanes when travelling between different countries.

In this project we will build our own torch that we can carry in a smaller relay.

## Ideas

What can we use to detect a lit torch? Do we have anything in our kits that can detect light? What shall we use to represent the flame of the torch?

## Plan

To represent the flame we can use the lightbulb in our kits, since it is also nice and bright. We will also need some way to transfer the light from one person to the next, so we need some way for the microchip to detect if there is a bright light there. A light dependent resistor (LDR) will work nicely.

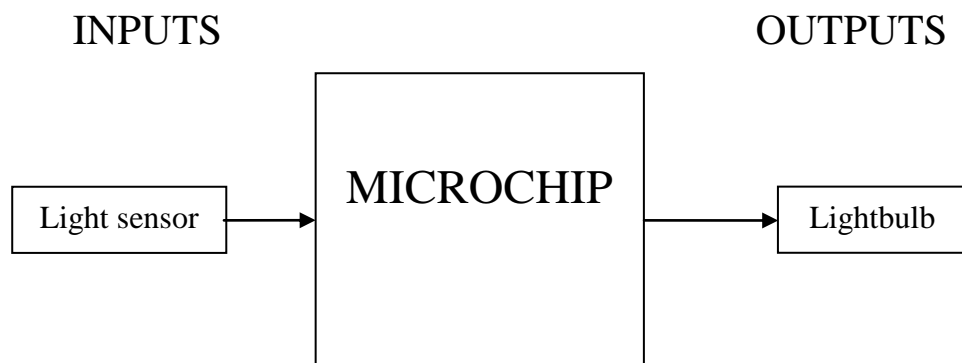


Figure 1: circuit plan

In order to achieve this, we will need to set a threshold value. If the light level is above this threshold it means someone is passing us the flame, or that we already have the flame, and the lightbulb should turn on. If the light level falls below the threshold, then there is no flame and the lightbulb should turn off.

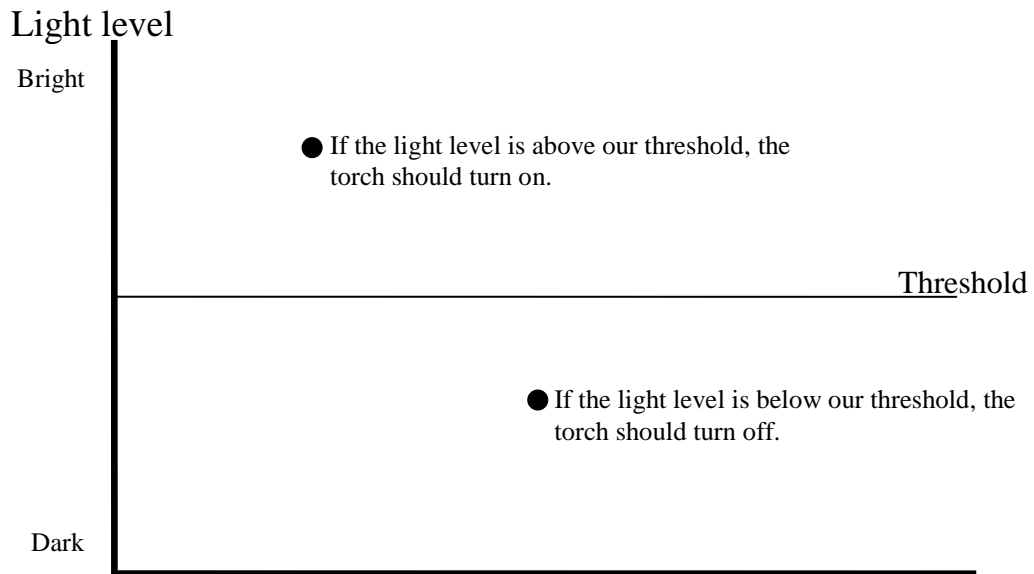


Figure 2: Threshold graph

## Design

Remember to use a driver icon to add the lightbulb. When you have added both the lightbulb and LDR to your circuit, it should look like this:

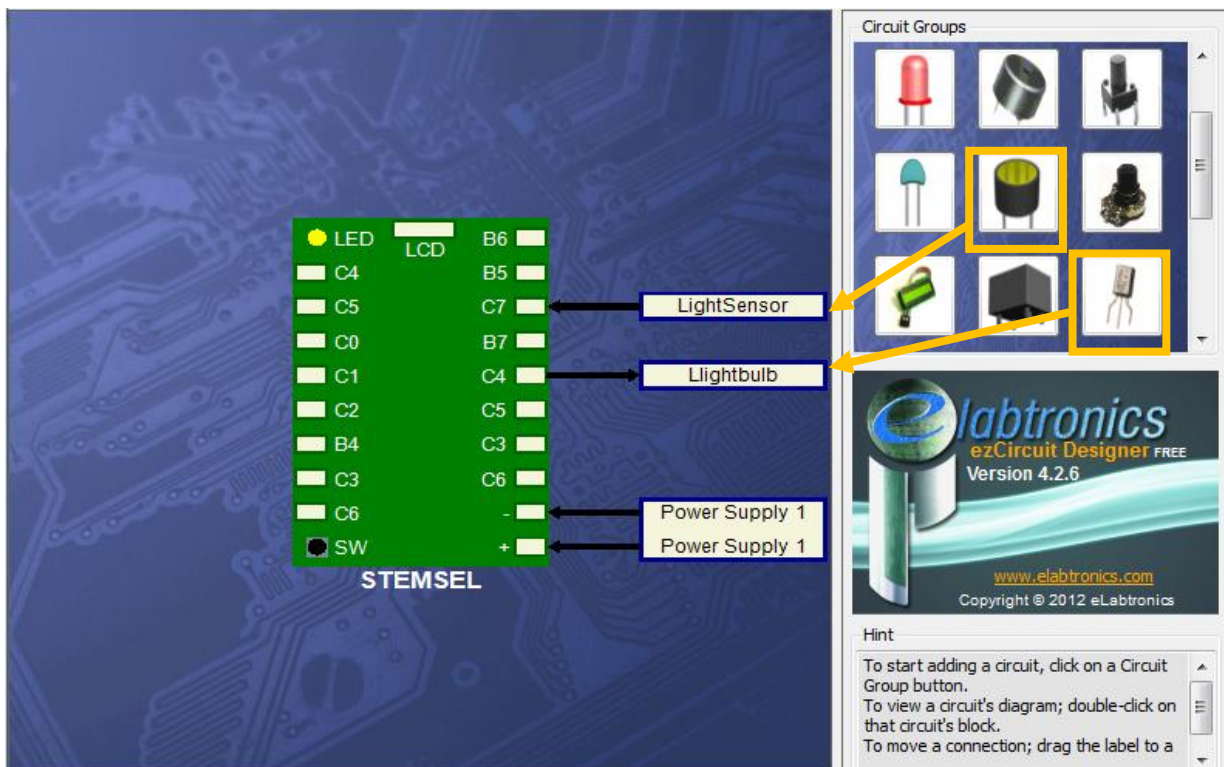


Figure 3: circuit design

## **Build the circuit**

Now we can build the circuit. Remember that black wires connect to the negative pin, red wires connect to the positive pin, and white wires connect to the pin we designated in our design.

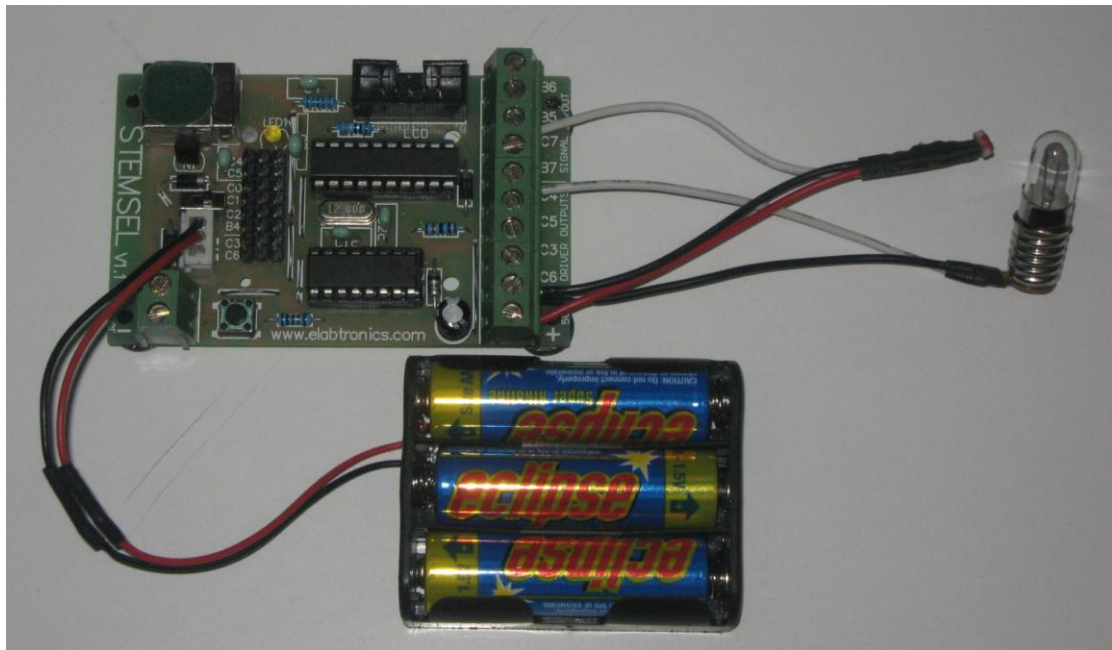


Figure 4: circuit

Once you have built your circuit, send the design to CoreChart, and test that the lightbulb is working by sending the test program to the chip. Then delete the test routine so we can start writing our own program.

## **Programming**

As we said in the plan, we want the lightbulb to turn on when the LDR (light sensor) detects bright light, but to stay off if it goes dark again.

1. First, use an AnalogIn icon (Inputs -> Analog\_In) to get the value of the LDR, and save it as LightVolts.
2. Use a Compare icon to compare LightVolts with a threshold value of 3V. Tick both the above and below cases.
3. We can see from the graph in the plan that if the light level is below the threshold of 3V then it is dark and we want our torch to turn off. Use an OnOffPin icon to turn the lightbulb off.
4. Similarly, if the light level is above the threshold of 3V then it is bright, which means that someone is passing us the flame, or we already have the flame, so we want to keep our torch lit. Use an OnOffPin icon to turn the lightbulb on.
5. Finally it would be no good if the program finished and turned the light off! Add a GoTo START icon to the end of the program so the program runs in a loop. The finished program is below:

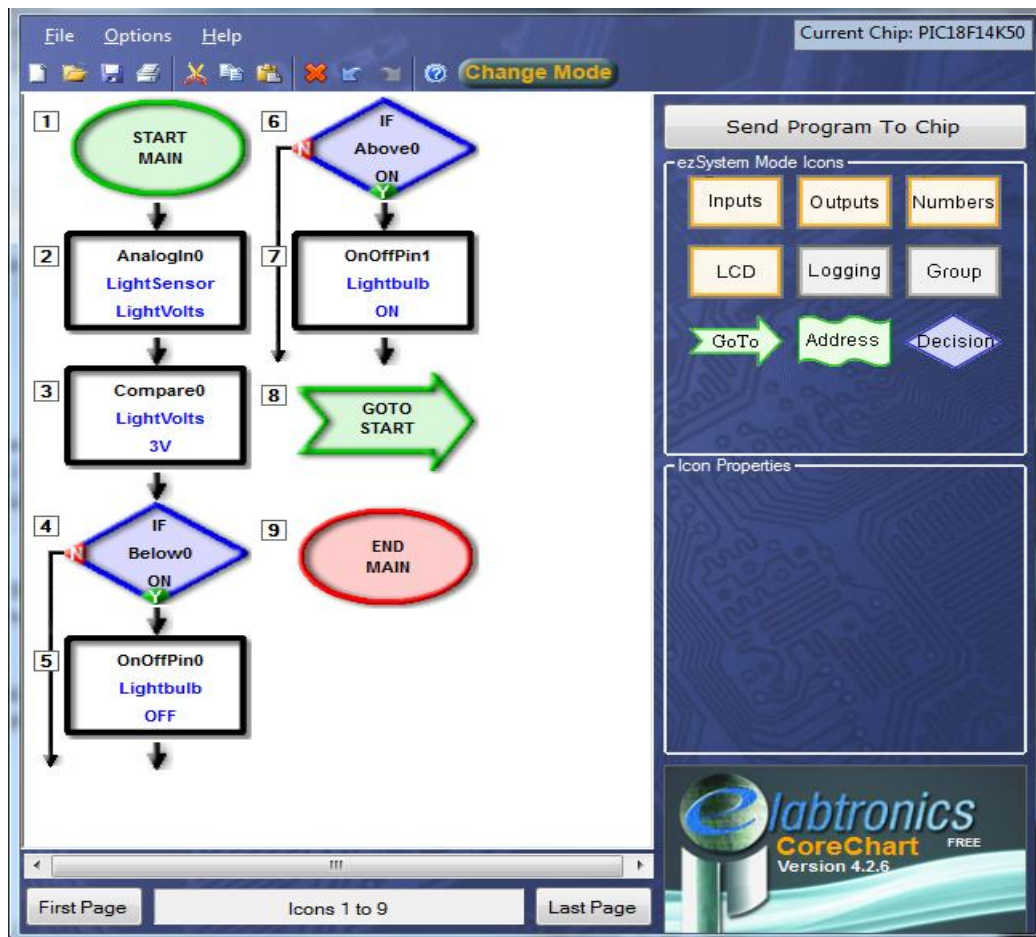


Figure 5: completed program

Send the program to the chip and see how it works. If you point your LDR at a bright light, your lightbulb should turn on, otherwise it should stay off. Make sure it goes off, as that will be important for the next part.

### Activity

Students should split into two groups, one on each side of the darkened room. All the torches should be off. Light one of the torches either from a light source or from a bright room. The LDR should be held close to the lightbulb to keep it alight. The person holding the lit torch should then cross the room to the other group and pass the flame on to the next person, who should then bring it back to the first side. If your torch goes out, return to the side of the room you started from and get the flame again. Continue crossing back and forth until everyone has carried the torch. Congratulations! You just had your own torch relay. You are all champions!

### Summary

The Olympics are one of the biggest sporting events in the world, and one of the most exciting parts actually happens before the Games even start; the Olympic torch relay. By passing the flame from one person to the next, the flame travels all the way around the world from Greece to the city where Olympics are held that year. In this project we used a LDR and a lightbulb to have our own torch relay, which was both fun and let us learn more about how to use microchips.