

ViSO CONTROLITE

ELECTRONICS PROJECT ①

ICT Programming Module

Activity Book

NAME:

TUTOR GROUP:

D&T GROUP:

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Building your own flashing badge

Design Brief

Design and make a flashing badge. The power circuit board (PCB) which fits into the back of the badge must be programmed to make a light sequence for six light-emitting diodes (LEDs). The design for the front of the badge must accommodate the six LEDs and one light dependent resistor (LDR).

Design Specification Points

- 1 The design will use a **PICAXE-08** microcontroller as its controller
- 2 The design will include six LEDs and one LDR
- 3 The holes will be punched in the badge front using a high precision punch
- 4 The design will be able to optionally react to different light levels

Designing your Flashing Badge

The most important thing to think about when designing your flashing badge is how the design can accommodate six LEDs and one LDR. A template has been provided to help you.

Other points to consider are:

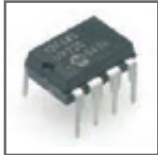
- 1 Safety.
- 2 What materials will you use to make the badge face? Paper? Textiles? Computer?

Extension

Instead of using the DACTA Controlite wizard to create the program to control the sequence of lights, try and create a program using a flowchart. To help you, see the data sheet available at www.picaxe.co.uk.

Electronic Components

The main components you will be using in your project are:



Picaxe Microcontroller



Light-Emitting Diode (LED)



Light Dependent Resistor (LDR)



Push Switch

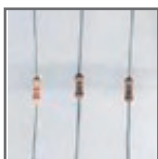


Battery

You will also need:



Picaxe Download Socket



Resistors

Microcontrollers

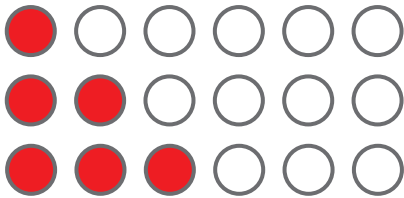
What is a microcontroller?

A microcontroller is often described as a 'computer-on-a-chip.' It is an integrated circuit that contains memory, processing units, and input/output circuitry in a single unit

Microcontrollers are purchased 'blank' and then programmed with a control program. You will be using programming editor software on the computer to program the microcontroller to produce light sequences.

TASK

How many different light sequences can be produced with six lights?



TIP – it is easier to be systematic in your approach to this task!

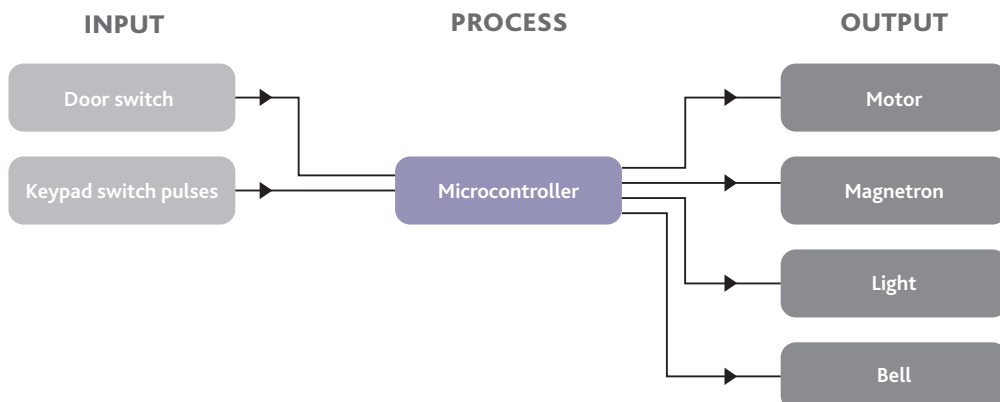
Where are microcontrollers used?

Applications that use microcontrollers include household appliances, alarm systems and vehicle subsystems. Some modern cars contain over thirty microcontrollers- used in a range of subsystems from engine management to remote locking.

As an example, a microwave oven may use a single microcontroller to process information from the keypad, display user information on the seven segment display, and control the output devices (turntable motor, light, bell and magnetron)

How are microcontrollers used?

Microcontrollers are used as the 'brain' in electronic circuits. These electronic circuits are often drawn visually as a 'block diagram.' A simplified block diagram for a microwave could be drawn like this:



TASK

Identify the input and output devices in your project and draw a flow diagram using the microwave example to help you.



How are programs written?

Programs can be created on the computer by using flowcharts or by being typed as 'BASIC' listings. To help you with this project we have created a programming wizard so you don't have to learn the programming language. Details are shown later in this booklet.

How is the program transferred to the microcontroller?

The microcontroller is programmed by connecting a cable from the serial port at the back of the computer to a socket on the PCB. This socket looks like a headphone socket similar to that on a portable CD player. This connection allows the computer and the microcontroller to 'talk' to each other and allow a new program to be downloaded into the microcontroller's memory.

Light-Emitting Diodes (LEDs)

What is an LED?

A light-emitting diode is an electronic component that gives out light when current passes through it. An LED is a special type of diode. A diode is a component that only allows current to flow in one direction. This means that when LEDs are connected to a circuit they must be the right way round.

The positive (anode) leg of an LED is longer than the negative (cathode) leg. The negative leg also has a flat edge on the plastic casing of the LED.

What are LEDs used for?

LEDs are mainly used as indicator lights. Red and green LEDs are commonly used on electronic appliances like televisions to show if they are switched on or in 'standby' mode.

? THINK POINT


Can you think of any other products that use LEDs?

≡ TASK

- 1 Sketch a **light-emitting diode (LED)**, colour it and label the **anode** and **cathode**. Your sketch should also show how the legs could be identified if both had been cut to the same length.



- 2 Draw the symbol for an LED.



Continued...

 **TASK** *continued*

3 Explain three advantages of using an LED instead of a bulb in your project work.

1.
2.
3.

4 What will happen if an LED is not connected the right way round in a circuit?

--

Light Dependent Resistors (LDRs)

What is an LDR?

A light dependent resistor is a special type of resistor that reacts to changes in light level.

What are LDRs used for?

LDRs are used in automatic street lamps to switch them on at night and off during the day.

How do LDRs work?

The simplest way to use an LDR is a simple on-off digital switch, when the light level is above a certain value the LDR will provide an on signal, when the light level is below a certain value the LDR will provide an off signal.

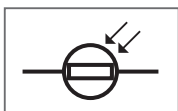
In a light sensor circuit when the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. This means the LED does not light.

However, when light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor. This means the LED lights.

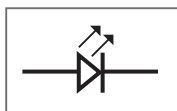
TASK

Can you draw a circuit illustrating the light sensor using the symbols given below?

LDR



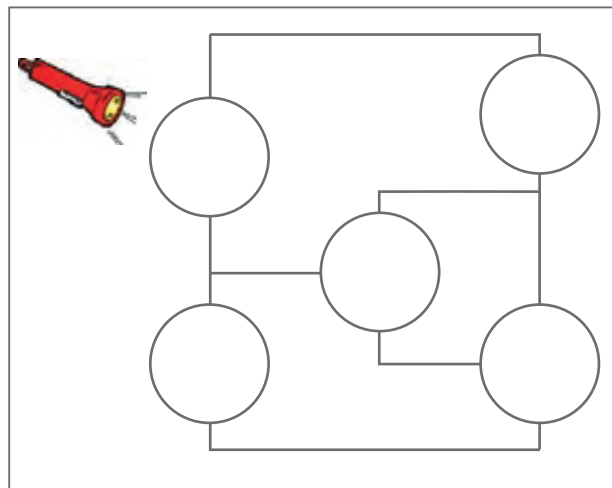
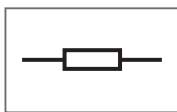
LED



Transistor



Resistor



Explain what a threshold value is:

Power

Your flashing badge will be powered by a battery (cell). A battery is a store of electronic energy. It is a portable power supply. Batteries contain chemicals that store energy. When connected into a circuit this chemical energy is converted to electrical energy that can then power the circuit.

TASK

- 1 Draw the symbol for a cell



- 2 Draw the symbol for a battery



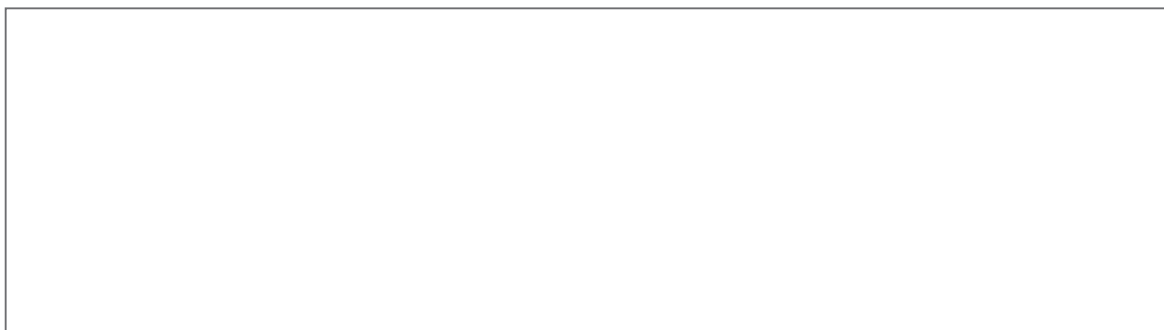
- 3 Draw two cells in parallel and label the voltage



- 4 Draw two cells in series and label the voltage



- 5 In what way are cells connected in parallel better than cells in series?



Initial Ideas

The printed circuit board has been designed to fit in the back of a badge, you are going to design the front of the badge so the design can accommodate for six LEDs which you can program. One of your targets is to make the badge as eye-catching as possible.

Task

Use the spaces below to design your initial ideas.

Developing the Program

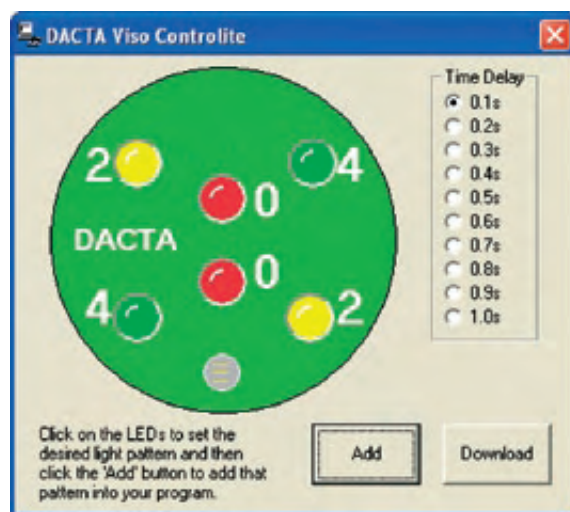
Detailed instructions for using the programming wizard

- 1 Start the Programming Editor Software.
- 2 Select the **View>Options** menu and make sure the mode is set to 'PICAXE-08'.
- 3 From the PICAXE menu select **Wizards>VISO Controlite**.

The following screen will appear:

- 4 Use the mouse to click on the grey LED squares to create a light pattern and then select a time delay on the right-hand side between steps. Every time the **Add** button is pressed the current pattern will be added to the program you are creating.
- 5 When you have completed your program, make sure the cable is connected to the PCB (this is from the USB port of your computer) then click the **Download** button to download the new program.

When the download is complete remove the cable. The light pattern should then run whenever the rear switch is pushed.

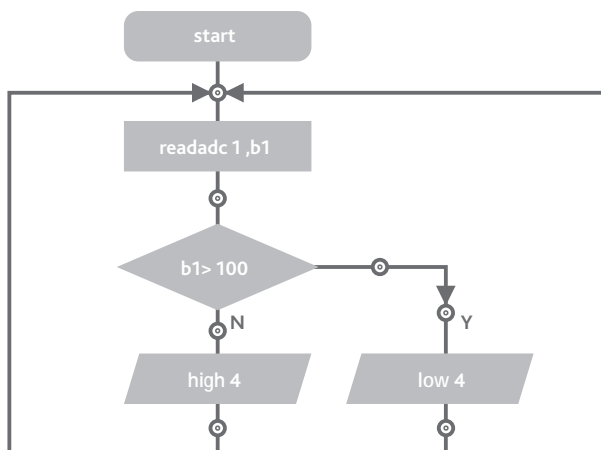


Extension

Programming the Light Dependent Resistor

The LDR can be programmed to carry out different commands when there is a change in the brightness of light.

Can you work out what command the following flow chart would carry out?



Continued...

ANSWER

This program will light output 4 when the light value changes.

In programming language it would be written as:

```
main:  
readadc 1,b1  
if b1 > 100 then led_off
```

```
led_off:  
low 4  
goto main
```

```
led_on:  
high 4  
goto main
```

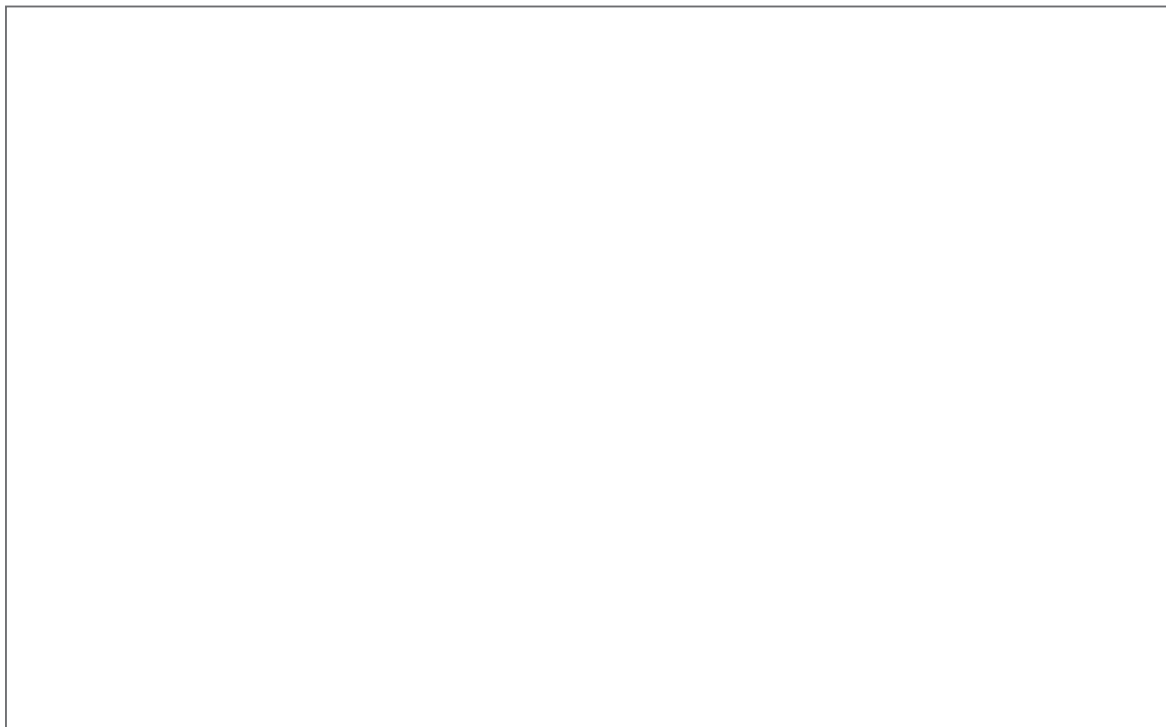
TASK

Produce a flow chart (below) that will light output 2 when the light value is >50. Test the program on-screen and then convert the program to basic before downloading it onto the circuit board.

You can test the operation of the sensor before hand by using this program:

```
main:  
readadc 1,b1  
debug  
pause 250  
goto main
```

On screen you should see the analogue value (in b1) changing as you cover / expose the light sensor.



Templates and Jigs

You have designed the badge face to accommodate six LEDs and one LDR. These components are in a fixed position so it is important that when you punch the holes for the LEDs to go through there is a good degree of accuracy. This is why a jig has been made for you to use.

What is a jig?

A jig is a device that holds a piece of work and guides the tools operating it. In this project the jig is what guides the punch.

THINK POINT

Can you think of a jig that is used in a real-life situation?

What is a template?

A template is very similar to a jig. It is used as a guide or a gauge to replicate shapes.

TASK

Design a template that can be used to help you when designing the badge face. This will help you base your design around the position of the lights.

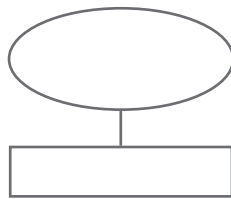
THINK POINT

What materials will you use to make your template? Can it be used again?

Assembly

TASK

Think about the different processes that you will need to carry out in order to complete your project. Try to illustrate these processes in a flow chart.



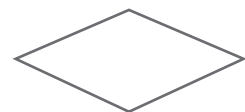
Start/End



Process



Input/Output



Decision

How long will it take?

Item	Mins	5	10	15	20	25	30	35	40	45	50	55	60
Design badge front	Estimated												
	Actual												
Make the badge	Estimated												
	Actual												
Punch holes	Estimated												
	Actual												
Bezel clips	Estimated												
	Actual												
Create program	Estimated												
	Actual												
Test	Estimated												
	Actual												
Connect cable	Estimated												
	Actual												
Download	Estimated												
	Actual												
Test	Estimated												
	Actual												
Reprogram	Estimated												
	Actual												
Test	Estimated												
	Actual												
Place PCB in badge	Estimated												
	Actual												

Colour in the estimated and actual rows in different colours. The estimated should be done before you make and the actual afterwards. In some cases more than one thing can be done in the same 5 minute slot and others may take more than 5 minutes.

I think the total time for making will be: Less than 1 hour , 1 hour , More than 1 hour .

Evaluation

During the making which parts were you pleased with and why?

Which parts of your making could be improved and why?

What new skills did you learn?

If you could do it again what would you do differently?

Did you get left behind at all? What could you do to stop this happening again?

Marking

TEACHER USE ONLY

Attainment

Effort

Targets for improvement

Comments