

## Curriculum Intent:

To use creativity and imagination to design and make products that solve real and relevant problems within a variety of contexts, considering their own and others' needs, wants and values and to be able to evaluate past and present design technology, its uses and



Subject	Term	Unit
DT	Spring	Electrical systems – Monitoring and control Alarming Vehicles

Prior knowledge Building on knowledge and skills	National Curriculum Focus
<ul style="list-style-type: none"> <li>• Initial experience of using computer control software and an interface box, a standalone box or microcontroller, e.g. Crumble.</li> <li>• Some experience of writing and modifying a program to make a light turn on or flash on and off.</li> <li>• Understanding of the essential characteristics of a series circuit and experience of creating a battery- powered, functional, electrical product.</li> </ul>	<p><b>Design</b></p> <ul style="list-style-type: none"> <li>• use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups</li> <li>• generate, develop, model and communicate their ideas through discussion, annotated sketches, cross-sectional and exploded diagrams, prototypes, pattern pieces and computer-aided design</li> </ul> <p><b>Make</b></p> <ul style="list-style-type: none"> <li>• select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing], accurately</li> <li>• select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to</li> </ul>

their functional properties and aesthetic qualities

**Evaluate**

- investigate and analyse a range of existing products
- evaluate their ideas and products against their own design criteria and consider the views of others to improve their work
- understand how key events and individuals in design and technology have helped shape the world

**What?**

Designing, making and evaluating an alarm.

**Why?**

To begin to understand how to safely build a circuit.

**Key vocabulary**

<b>Program</b>	A sequence of instructions that can be used to control electrical components.	<b>Light emitting diode (LED)</b>	An output device that glows when electricity is passed through it.
<b>Microcontroller</b>	a device that can be programmed to control how an electrical product operates.	<b>System</b>	A set of related parts or components that together achieve a desired outcome.
<b>System</b>	A set of related parts or components that together achieve a desired outcome.	<b>Output devices</b>	components that produce an outcome e.g. bulbs, motors and buzzers.

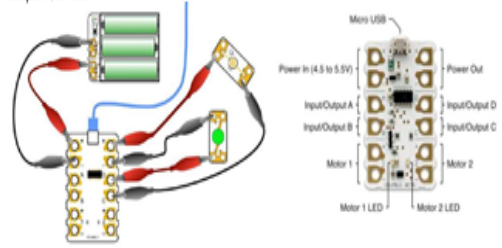
<b>Input devices</b>	Components that produce an outcome e.g. bulbs, motors and buzzers.	<b>Process</b>	How a computer program controls one or more output devices.
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## Key learning

Objective	Learning
<p>Can I explore and evaluate a range of existing products?</p>	<ul style="list-style-type: none"> <li>Discuss a range of relevant products (such as nightlights, garden lights, alarm systems, security lighting, electronic moneyboxes) that respond to changes in the environment using a computer control program e.g. Why is a computer control program used to operate the products? What are the advantages of using computer control? What input devices, e.g. switches, and output devices, e.g. bulbs and buzzers, have been used? Who have the products been designed for and for what purpose?</li> <li>Investigate sensors such as light</li> </ul>

### Connecting up a Crumble

This arrangement is for an automatic nightlight, using a light dependent resistor (LDR) as the monitoring or input device and a light emitting diode (LED) as the output device.



**Example programs for an automatic nightlight**

The LED connected to output D switches on when it goes dark. Change the value of the LDR connected to terminal C so that the system is activated at different light levels.

**program start**

```

do forever
  if C is LO then
    set LED to HI
    wait 1 seconds
    set LED to LO
  end if
loop

```

**program start**

```

do forever
  if analogue C < 200 then
    set LED to HI
  else
    set LED to LO
  end if
loop

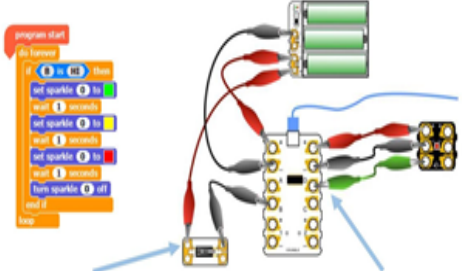
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LED - connect +ve to D and -ve to Power Out

LDR - connect -ve to C and +ve to Power Out

**An example program for an electronic toy moneybox**

A sparkle LED is connected to the Crumble and changes from green to yellow to red every time a plastic coin is placed through the slot of the moneybox and depresses a micro switch connected to terminal B.



**program start**

```

do forever
  if B is HI then
    set sparkle to green
    wait 1 seconds
    set sparkle to yellow
    wait 1 seconds
    set sparkle to red
    wait 1 seconds
    turn sparkle off
  end if
loop

```

- How could children adapt the program so that it would detect a burglar stealing the moneybox?
- What type of output device could they use?
- What type of switch could detect the movement of the moneybox?
- How could the program be adapted to remind the user to save money on a regular basis?

Once the Crumble has been programmed, it will remember the program and run it automatically when the USB cable is disconnected.

	<p>dependent resistors (LDRs) and a range of switches such as push-to-make, push-to-break, toggle, micro and reed switches. To gain an understanding of how they are operated by the user and how they work, ask the children to use each component to control a bulb in a simple circuit. Remind children about the dangers of mains electricity.</p> <ul style="list-style-type: none"><li>• Children could research famous inventors related to the project e.g. Thomas Edison – light bulb.</li></ul>	
<p>Can I explore how to make a circuit?</p>	<ul style="list-style-type: none"><li>• Through teacher demonstration and explanation, recap measuring, marking out, cutting and joining skills with construction materials that children will</li></ul>	

need to create their electrical products.

- Using a model circuit, demonstrate and enable children to practise using different input and output devices. Allow them to practise methods for making secure electrical connections e.g. using wire strippers, twist and tape connections, screw connections, crocodile clips and connecting blocks.
- Remind children how to avoid making short circuits.
- Drawing on science understanding, ask the children to explore a range of electrical systems that could be used to

control their products, including a simple series circuit where a single output device is controlled, a series circuit where two output devices are controlled by one switch and, where appropriate, parallel circuits where two output devices are controlled independently by two separate switches.

- Drawing on related computing activities, ensure that children can write and modify computer control programs that include inputs, outputs and decision making. Test out the programs using electrical components connected to

	microcontrollers, interface boxes or standalone boxes.	
Can I design purposeful, functional, appealing products for themselves and other users based on a design criteria?	<ul style="list-style-type: none"><li>• Develop an authentic and meaningful design brief with the children.</li><li>• Ask the children to generate innovative ideas by drawing on research and develop a design specification for their product, carefully considering the purpose and needs of the intended user.</li><li>• Communicate ideas through annotated sketches, pictorial representations of electrical circuits or circuit diagrams, including the microcontroller, interface box or standalone box to be used. Drawings should indicate the design decisions made, including the location of the electrical components and</li></ul>	

	<p>how they work as a system with an input, process and output. Reference should be made to the control program used and how it will operate to control the inputs and outputs</p>	
<p>Can I select from and use a range of tools, equipment, materials and components to make a product?</p>	<ul style="list-style-type: none"> <li>• Produce detailed step-by-step plans and lists of tools, equipment and materials needed. If appropriate, allocate tasks within a team.</li> <li>• Make high quality products, applying knowledge, understanding and skills from IEAs and FTs. Create and modify a computer control program to enable the product to work automatically in response to changes in the environment.</li> </ul>	
<p>Can I evaluate</p>	<ul style="list-style-type: none"> <li>• Critically evaluate throughout and the</li> </ul>	

<p>their ideas and products against a design criteria?</p>	<p>final product, comparing it to the original design specification. Test the system to demonstrate its effectiveness for the intended user and purpose.</p>	
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### Websites

- [Primary Crumble Controller Starter Kit](#)
- [Crumble-friendly Components Pack](#)
- [Primary Subject Leaders' File Sections 5.8 and 5.10](#)
- [Applying Computing in D&T at KS2 and KS3](#)
- [Alarming vehicles](#)
- [Designing and making alarm circuits using inputs with computer control](#)
- [Developing handmade switches](#)
- [Hand-made switches helpsheet](#)

### Recommended Reads

