

1. Year Groups
Year 6

2. Aspect of D&T
Electrical systems
Focus
Monitoring and control

3. Key learning in design and technology
Prior learning

- Initial experience of using computer control software and an interface box, a standalone box or microcontroller, e.g. Crumble.
- Some experience of writing and modifying a program to make a light turn on or flash on and off.
- Understanding of the essential characteristics of a series circuit and experience of creating a battery-powered, functional, electrical product.

Designing

- Develop a design specification for a functional product that responds automatically to changes in the environment.
- Generate, develop and communicate ideas through discussion, annotated sketches and pictorial representations of electrical circuits or circuit diagrams.

Making

- Formulate a step-by-step plan to guide making, listing tools, equipment, materials and components.
- Competently select and accurately assemble materials, and securely connect electrical components to produce a reliable, functional product.
- Create and modify a computer control program to enable their electrical product to respond to changes in the environment.

Evaluating

- Continually evaluate and modify the working features of the product to match the initial design specification.
- Test the system to demonstrate its effectiveness for the intended user and purpose.

Technical knowledge and understanding

- Understand and use electrical systems in their products.
- Understand the use of computer control systems in products.
- Apply their understanding of computing to program, monitor and control their products.
- Know and use technical vocabulary relevant to monitoring and control.

4. What could children design, make and evaluate?

cycle or vehicle alarm security lighting system
alarm for valuable artefact garden light
automatic nightlight electronic moneybox
alarm for school shed other – specify

7. Links to topics/themes

Our School Toys and Games
Keep Safe Ourselves
Culture and Leisure Travel Homes
Buildings other – specify

5. Intended users

vehicle or cycle owner school community
school administrator themselves siblings
parents security staff other – specify

8. Possible contexts

home school community culture
leisure enterprise business
other – specify

6. Purpose of products

safety protection security detection
warning comfort illumination entertainment
other – specify

9. Project title

Design, make and evaluate a _____ (product) for _____ (user) for _____ (purpose).
To be completed by the teacher. Use the project title to set the scene for children’s learning prior to activities in 10, 12 and 14.

10. Investigative and Evaluative Activities (IEAs)

- 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?*
- Investigate sensors such as light 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.
- Children could research famous inventors related to the project e.g. Thomas Edison – light bulb.

12. Focused Tasks (FTs)

- Through teacher demonstration and explanation, recap measuring, marking out, cutting and joining skills with construction materials that children will 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.

14. Design, Make and Evaluate Assignment (DMEA)

- Develop an authentic and meaningful design brief with the children.
- 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.
- 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 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.
- Produce detailed step-by-step plans and lists of tools, equipment and materials needed. If appropriate, allocate tasks within a team.
- 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.
- Critically evaluate throughout and the final product, comparing it to the original design specification. Test the system to demonstrate its effectiveness for the intended user and purpose.

11. Related learning in other subjects

- Spoken Language** – ask relevant questions, give well-structured descriptions and explanations. Build technical vocabulary.
- Computing** – use technologies for research purposes and be discerning when evaluating digital content.
- Science** – apply knowledge and understanding of circuits, switches, conductors and insulators.

13. Related learning in other subjects

- Science** – apply knowledge and understanding of circuits, switches, conductors and insulators.
- Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems. Use sequence, selection, and repetition in programs. Work with variables and various forms of input and output.
- Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.
- Spoken language** – asking questions to check understanding, develop technical vocabulary and build knowledge.

15. Related learning in other subjects

- Mathematics** – apply understanding and skill to carry out accurate measuring using standard units i.e. cm/mm.
- Science** – apply knowledge and understanding of circuits, switches, conductors and insulators.
- Computing** – design, write and debug programs that accomplish specific goals, including controlling physical systems. Use sequence, selection, and repetition in programs. Work with variables and various forms of input and output.
- Spoken language** – maintain attention and participate actively in collaborative conversations, staying on topic and initiating and responding to comments. Develop understanding through speculating, hypothesising, imagining and exploring ideas.

16. Possible resources

microcontroller or standalone control box or interface box
collection of battery-powered, manually-controlled and programmable products
batteries, battery holders, crocodile leads
different output devices including bulbs with bulb holders, buzzers, light emitting diodes (LEDs), motors
different input devices including micro switches, reed switches and magnets, light dependent resistors (LDRs)
wire, automatic wire strippers, masking tape, construction materials and tools as required

17. Key vocabulary

reed switch, toggle switch, push-to-make switch, push-to-break switch, light dependent resistor (LDR), tilt switch
light emitting diode (LED), bulb, bulb holder, battery, battery holder, USB cable, wire, insulator, conductor, crocodile clip
control, program, system, input device, output device, series circuit, parallel circuit
function, innovative, design specification, design brief, user, purpose

18. Key competencies

problem-solving teamwork negotiation
consumer awareness organisation motivation
persuasion leadership perseverance
other – specify

19. Health and safety

Pupils should be taught to work safely, using tools, equipment, materials, components and techniques appropriate to the task. Risk assessments should be carried out prior to undertaking this project.

